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THESIS

A UNIFIED GENERAL FRAMEWORK OF INSURGENCY USING A LIVING SYSTEMS APPROACH

by

Shanece L. Kendall

June 2008

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This thesis develops a unified general framework of insurgency. The framework is "unifying" in that it includes all the physical and social science formulations of insurgencies and both contemporary and historical insurgencies. It is "general" in that it describes all insurgencies rather than a specific one. This thesis first redefines the definition of insurgency in the context of the twenty-first century and addresses the military, political, social, and economic elements. Next, it adopts the view that an insurgency is a living system. This idea is based on the characteristic that every insurgency consists of a group of people embedded in a larger society. Using this concept, this thesis argues that James Grier Miller's Living Systems Theory, from his book *Living Systems*, is the most fitting theory to study insurgency. To demonstrate the framework's effectiveness, it is applied to the Iraq Sunni Insurgency. The framework is used to describe the structure of the insurgency system using three levels—insurgency, Improvised Explosive Device (IED) Unit, and IED Cell—and the twenty critical subsystems that process information and matter-energy in the insurgency's IED Cell. This framework should help clarify, focus, and support the current debates about policy, operations, and tactics for insurgencies.

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A UNIFIED GENERAL FRAMEWORK OF INSURGENCY USING A LIVING SYSTEMS APPROACH

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ABSTRACT

This thesis develops a unified general framework of insurgency. The framework is "unifying" in that it includes all the physical and social science formulations of insurgencies and both contemporary and historical insurgencies. It is "general" in that it describes all insurgencies rather than a specific one. This thesis first redefines the definition of insurgency in the context of the twenty-first century and addresses the military, political, social, and economic elements. Next, it adopts the view that an insurgency is a living system. This idea is based on the characteristic that every insurgency consists of a group of people embedded in a larger society. Using this concept, this thesis argues that James Grier Miller's Living Systems Theory, from his book *Living Systems*, is the most fitting theory to study insurgency. To demonstrate the framework's effectiveness, it is applied to the Iraq Sunni Insurgency. The framework is used to describe the structure of the insurgency system using three levels—insurgency, Improvised Explosive Device (IED) Unit, and IED Cell—and the twenty critical subsystems that process information and matter-energy in the insurgency's IED Cell. This framework should help clarify, focus, and support the current debates about policy, operations, and tactics for insurgencies.

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EXECUTIVE SUMMARY

The term *insurgency* has been used for several years in the professional military literature. The term has been commonly confused with *guerrilla warfare*, *terrorism*, and other terminology on this subject. Decision makers, government agencies, and military leaders each have their own definition of the term *insurgency* and, hence, cannot agree on a suitable definition for the term. Due to the inconsistencies in the term's definition, it has led to a confused state of debates about policy, operations, and tactics for insurgencies. There are two sources of confusion in the debates: 1) the inability to distinguish between different points of view and different understandings of the definitions, vocabularies, structures and processes associated with insurgencies; and 2) the decision to classify a conflict as an insurgency rather than political violence, civil war, conventional warfare, or other category. Because of these two debates and the varying viewpoints among decision makers, military leaders and government agencies, a unified general framework of insurgency does not exist.

Currently, many analysts use historical analysis, political science, warfare, anthropology, mathematics, sociology, and other disciplines and approaches as frameworks to define and describe insurgency. The different frameworks have led to multiple, conflicting definitions and descriptions of insurgencies that have made it difficult for policy makers to develop effective United States foreign policy. For example, a historical analysis forces decision makers and military leaders to put insurgencies in categories and, thus, programming them to think "in a box". Insurgencies have also been classified as a type of warfare that can only be defeated using military force. This approach only leads to military solutions and objectives. In addition to these approaches, some have used social and life science approaches that view insurgencies as living systems. Many of the major concepts in each discipline are inadequate and, in some cases, inapplicable to describing all insurgencies.

For all of these reasons, this thesis argues that it is necessary that everyone, including the defense agencies, military leaders, decision makers, and academic scholars, have a shared general framework when discussing insurgency. Such a framework provides a language and structure to support a more productive dialogue among policy makers, military leaders, decision makers and government agencies.

This thesis develops a unified general framework of insurgency drawing on central concepts and terminology from James Grier Miller's Living Systems Theory. The framework is "unifying" in that it includes all the physical and social science formulations of insurgencies and both contemporary and historical insurgencies. It is "general" in that it describes all insurgencies rather than a specific one. The framework fulfills the need for a scientific and general description of insurgency. In order to construct this framework, this thesis first identifies a broad, inclusive definition of insurgency in the context of the twenty-first century, addressing the military, political, social, and economic elements of an insurgency, which are often excluded in other approaches. Next, it adopts the view that an insurgency is a living system that shares similar characteristics to other living systems, such as inputs, outputs, throughputs and processes. It adopts the neutral, interdisciplinary vocabulary from Living Systems Theory to describe the structure and processes of insurgency.

To demonstrate the effectiveness of the unified general framework of insurgency, we contrast it to four alternate approaches—social networks, sociobiology, ecology, and complex adaptive systems—that are currently being explored to describe insurgency. We then apply the framework to the Sunni Insurgency in Iraq, and use it to describe the structure of that insurgency's system using three levels—insurgency, IED Unit, and IED Cell—and the twenty critical subsystems that process information and matter-energy in the insurgency's IED Cell.

The framework constructed here is a descriptive model. The two major shortcomings of this framework are it does not adequately incorporate either the dynamics of an insurgency or any feedback mechanisms. This thesis argues that it is necessary first to develop a descriptive model of insurgency that serves as a solid foundation for explanatory models that can adequately incorporate these two features.

This thesis argues a living systems approach is a better approach to describing insurgency than existing approaches. This framework should help clarify, focus, and support the current debates about policy, operations, and tactics for insurgencies.

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I.   INTRODUCTION

A.   PURPOSE OF RESEARCH

Insurgency is a subject that is especially difficult to understand due to its various interpretations. Discussions and studies of insurgency are replete with anecdotes and assertions, but one does not find an accepted scientific methodology or approach that attempts to clarify the vocabulary and theory associated with insurgency problems. Writers and commentators are quick to voice their assertions and affirmations about what policies should be followed to defeat insurgencies and what mistakes have been made in the past when the United States had to deal with insurgencies. Yet, very few critics attempt to formulate new approaches based on their affirmations and assertions. A lack of interest in formulating a scientific approach that provides a general accepted definition and description of insurgency has limited renewed thinking on this subject.

There is no generally agreed upon framework for insurgency, which would include a definition, vocabulary, and description. Thus, there is no agreement on insurgency scope (e.g., military, political, economic, social), operations (e.g., guerrilla, terror, political, social), objectives (e.g., revolution, political power) and causes (e.g., poverty, social injustice), just to name a few. More importantly, there is not a common framework to discuss insurgency; currently, analysts use historical analysis, political science, warfare, anthropology, mathematics, sociology, and other disciplines and approaches. The different frameworks have lead to multiple, conflicting definitions and descriptions of insurgencies that have made it difficult for policy makers to develop effective United States foreign policy.

Historical analysis, for instance, has been used to analyze and categorize insurgencies. This approach gives diverse and sometimes controversial definitions and descriptions of this evolving type of warfare. Some features are applicable to all insurgencies while other features are only applicable to a specific insurgency. Many critics believe a historical approach not only provides decision makers and military leaders with limited definitions and descriptions of insurgency, but also programs them to think "in a box", making them more prone to misclassification.

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Insurgencies have often been classified as a type of warfare that can only be defeated using military force. Adopting the warfare view triggers the use of military vocabulary and principles and, in turn, leads to formulating military solutions and objectives. Because the military approach is narrow in scope, it fails to analyze the social, political and economic aspects of insurgencies, which are, in some cases, more influential on their functions and direction.

In addition to the historical analysis and military approaches, some analysts have used social and life science approaches to understand and describe insurgencies. These approaches include the following scientific disciplines: social networks, sociobiology, ecology, and complex adaptive systems. All of these approaches view insurgencies as living systems, which is defined in Chapter III. However, they each have different depictions, principles and terminology that attempt to describe the same system. Many of the major concepts in each discipline are inadequate and, in some cases, inapplicable to describing all insurgencies.

The approaches discussed above are just one demonstration of the need for a unifying general framework for defining and describing insurgencies. The current confused state of the debate about policy, operations, and tactics for insurgencies is another critical demonstration of the urgent need for a new general framework to understand and describe them. There are two sources of confusion in those debates. The first source of confusion is the inability to distinguish between different points of view and different understandings of the definitions, vocabularies, structures, and processes associated with insurgencies. Many participants have implicitly or explicitly defined and described present and past insurgencies to support their point of view. Often there are policy and operations proposals that are based on hidden and flawed generalized assumptions about insurgencies. In order to make these proposals more effective for wide application to all insurgencies, the participants need a clearer understanding of the structure of insurgencies and how resources and information are processed within the insurgency.

The second source of confusion surrounds the decision to classify a conflict as an insurgency rather than political violence, civil war, conventional warfare, or other category. This is an important issue that affects whether the military should be the lead actor or the sole actor in counterinsurgent operations and to what extent the military, especially the Army and Marine Corps, should recruit, organize, and train for counterinsurgent missions rather than for the full spectrum operations of conventional warfare. Some suggest that the military should first assess the current nature of insurgency and determine how the principles and lessons from previous insurgencies can be used to further our understanding of insurgencies fought in the twenty-first century. Part of this debate is whether the United States should adopt a "whole-of-government" approach to determine the division of responsibility among the military and other government agencies. This includes determining which agencies should develop and maintain a work force to support a wide variety of capabilities, including foreign language expertise, culture understanding, economic development, legal and criminal advice, and political development advice.

In order for these debates to be productive and ultimately decisive, it is necessary to have a shared framework. Everyone, including decision makers and military leaders, need to speak the same language when discussing insurgencies and refrain from using analytical, descriptive approaches that are too narrow in scope. Also, everyone needs to be equipped with a broad, inclusive definition of insurgency and have access to a unified general framework that describes insurgency structure and processes, using historical examples as a frame of reference. A fundamental understanding and definition of insurgencies as well as an approach to describe their complex nature is imperative in creating foreign policy that deals with all types of insurgencies.

This thesis develops a unified general framework of insurgency. It first redefines the definition of insurgency in the context of the twenty-first century and addresses the military, political, social, and economic elements. Next, it adopts the view that an insurgency is a living system. This idea is based on the characteristic that every insurgency consists of a group of people embedded in a larger society. The term *living system* includes individual people, small groups, organization, nations and supranational

organizations. Using this concept, this thesis argues that James Grier Miller's Living Systems Theory, from his book *Living Systems*, is the most fitting theory to study insurgency. Living Systems Theory is a unified general framework of all living systems from the cell through supranational organizations that provides a vocabulary that encompasses the physical, biological, and social sciences. A unified general framework based on Living Systems Theory yields a better framework to describe all insurgencies. The framework is "unifying" in that it includes all the physical and social science formulations of insurgencies and both contemporary and historical insurgencies. It is "general" in that it describes all insurgencies rather a specific one. This unified general framework should support a more productive dialogue among policy makers, military leaders and scholars, limit the misuse of historical examples, and identify hidden assumptions.

The unified general framework of insurgency presented in this thesis is applied to a specific insurgency, the Sunni Insurgency in Iraq. In particular, the framework is used to analyze the following three levels in the Sunni Insurgency: 1) the insurgency; 2) the IED Unit; and 3) the IED Cell.

The terminology provided in Miller's Living Systems Theory is better suited to describe the structure and processes of each level vice the known military terminology used to describe insurgencies. The words currently being used to describe insurgencies are loaded with multiple meanings, for example, the term *insurgents, revolutionaries, terrorists, religious zealots, thugs*, and *criminals*. Selecting one of these terms dictates the context in which to analyze the insurgency. For example, if a person selects a religious term to describe an insurgency, then he or she has to analyze it in a religious context. Miller spent his entire career carefully selecting the terms he provides in his theory. In *Living Systems*, Miller writes why he selected the terms used in his theory:

> The terms should be as neutral as possible. Preferably they should not be associated exclusively with any type or level of system, with biological or social science, with any discipline, or with any particular school or theoretical point of view (Miller, 1995).

Thus, using Miller's terms to describe insurgencies forces decision makers and military leaders to view insurgencies in a living systems context. This thesis uses terms from Miller's theory as a basis to construct a general framework to describe insurgencies.

It should be stressed that the model presented in this paper is descriptive, not explanatory. It is necessary to have a generally accepted well defined descriptive model before attempting to construct an explanatory model. Creating an explanatory model is beyond the scope of this thesis.

B. THESIS ORGANIZATION

This thesis is structured into seven chapters. Chapter I introduces the purpose of this research and the organization of the thesis. Chapter II reviews the debate on the definition of insurgency. In particular, it discusses the current conceptualization of insurgencies and how this view hinders military leaders and decision makers from formulating new approaches that fully encompass the scope of insurgencies. Here we adopt a broad, inclusive definition of the term insurgency. The chapter reviews four approaches that use the social and life sciences to describe insurgency.

Chapter III gives an historical background of Miller's life, emphasizing the reason why he pursued a unified general framework. Later, the chapter addresses the primary concepts of Miller's Living Systems Theory, including a definition of living systems and a discussion on the concepts of space, time, matter, energy and information, and the characteristic elements associated with the eight levels of living systems. Chapter IV applies Miller's notion of levels to the Iraqi Sunni Insurgency. The chapter discusses the current view of the insurgency hierarchical structure, revising the structure to include levels. Chapter V discusses the twenty critical subsystems in Living Systems Theory, applying the vocabulary to describe an IED Cell. The chapter develops a diagram, which includes the twenty subsystems, to display the IED Cell's structure and processes. The approach discussed in this chapter can be further abstracted to understand how the higher levels in the insurgency interact with their subordinate levels.

Chapter VI assesses the unified general framework for insurgency developed here by identifying its limitations and comparing it to the four approaches discussed in Chapter II. Lastly, Chapter VII, the concluding chapter, highlights the key takeaways of this thesis.

II.   DESCRIBING AND DEFINING INSURGENCY

A.   OVERVIEW

The term *insurgency* has been used for several years in the professional military literature. The term has been used synonymously with other irregular warfare terms, such as *terrorism*, and *guerrilla warfare*. There have been over sixty reported insurgencies since World War II. They have existed in many countries and regions, including the Philippines, Vietnam, Afghanistan, Columbia and Iraq, just to name a few. Each insurgency had different objectives, but many writers believe all insurgencies are revolutionary in nature with the sole objective of the overthrow of the social, political, and economic order of their government by using subversion and terrorism. Recent studies have shown that many insurgencies are not revolutionary in nature nor do they all use terrorism to accomplish their objectives. Terrorism is but one tool used by insurgencies to assert their strength. Therefore, defeating an insurgency movement will require more than just using military force; it will require a new and bold thought process on the part of decision makers and military strategists. In order to revamp the current conceptualization of insurgencies it is imperative that decision makers and military leaders take a closer look at the current definition of the term insurgency and rethink the definition in the context of the nature of 21st century insurgent movements.

This chapter does the following three things: 1) reviews existing Department of Defense definitions of the term insurgency and discusses how this is preventing decision makers and military leaders from formulating new approaches to describe insurgencies; 2) gives a revised definition of the term that reflects more accurately the nature of 21st century insurgent movements; and 3) explores alternative approaches currently being used to "rethink" insurgencies with particular emphasis on the use of the social and life sciences to better describe them.

B.   CURRENT DEFINITION OF INSURGENCY

This is another type of war, new in its intensity, ancient in its origins—war by guerrillas, subversives, insurgents, assassins; war by ambush instead of by combat; by infiltration, instead of aggression, seeking victory by

eroding and exhausting the enemy instead of engaging him…It requires in those situations where we must counter it…a whole new kind of strategy, a wholly different kind of force, and therefore a new and wholly different kind of military training (Kennedy, 1962).

<div align="right">
John F. Kennedy
Former President of the United States
</div>

These words were spoken by President Kennedy in a speech he gave to the graduating class at West Point on June 6, 1962. In his speech, the former president explicitly defines the term *insurgency* as a type of warfare. With this definition, the president institutionalizes the notion that insurgencies can only be defeated using a military approach.

Applying the former president's approach in attempts to defeat the insurgency movements of the 21st century has severe implications for contemporary decision makers and military leaders. Today's insurgents are devising and using strategic, political, operational and tactical methods to defeat their enemy on many fronts. Strategically, insurgencies are changing the mindset of enemy policy makers and those who can influence them. Politically, they are exploiting their enemy's various allies, ranging from national to international, for their own purposes. Operationally, they are using their enemy's allies and modern technology to spread various messages intended to undermine the enemy's political will. And tactically, they are utilizing inexpensive industrial materials found throughout society such as chemicals, natural gas, and fertilizers, to launch violent attacks against their enemies (Hammes, 2005). Insurgencies are using "all available outlets—political, economic, social, international organizations, the media, the Internet, and world opinion—to make the enemy's goals seem unobtainable or too costly" (Hammes, 2005). They know they do not have to match the military superiority of their enemies. All they have to do is launch violent attacks against the population and any form of government infrastructure to undermine the enemy's will and gain support from the local populace.

A military approach is incapable of countering all of the above aspects currently being used by insurgents. A military approach is more useful in countering revolutionary insurgencies where a clear struggle exists between the insurgents and the regime in power

where each seeks to impose its will while trying to win the support of the local populace (Metz, 2007b). The insurgency movements that existed in Malaysia, the Philippines and Vietnam wanted to "undermine the ability of these poor countries to maintain the freedom that they have finally achieved" by employing conventional warfare methods to achieve their political objective (Kennedy, 1962). The military option, as stated by President Kennedy, would be the recommended approach to defeat such insurgency movement but would not be the most effective strategy to use against the more sophisticated insurgency movements in Afghanistan and Iraq.

Unfortunately, the military approach has become the accepted methodology in dissecting insurgencies. The idea that insurgencies are revolutionary movements has long dominated American thinking since Vietnam and the Cold War. Bard O'Neil attempts to counter the old American perspective on insurgencies by studying how insurgencies have transformed from Roman times to the present. In his book, *Insurgency and Terrorism: From Revolution to Apocalypse,* he noted that insurgencies have been the most common type of warfare since the establishment of formal governments (O'Neill, 2005). He reminds Americans that not all insurgencies are revolutionary even though the United States has only dealt with insurgencies of this type when they posed an eminent threat to its national interests.

Furthermore, he identifies nine types of insurgent movements ranging from anarchist to preservationist. According to O'Neill, not all of these types of insurgency movements seek to overthrow or replace their existing governments; some just wanted to display legitimacy over their governments. And if they realize that they do not have the overwhelming support of their local populace, they would try to orchestrate a civil war or create anarchy just to achieve their non-political goals. Armed with this perspective, O'Neill gives his revision of the term *insurgency*. He writes:

> Insurgency may be defined as a struggle between a non-ruling group and the ruling authorities in which the non-ruling group consciously uses political resources (e.g., organizational expertise, propaganda, and demonstrations) and violence to destroy, reformulate, or sustain the basis of legitimacy of one or more aspects of politics (O'Neill, 2005).

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O'Neill's logic, like many definitions of the term *insurgency,* tends to focus heavily on the political aspect of insurgencies.   Defining the term with the emphasis totally focused on the political perspective can also have severe implications for decision makers and military leaders.   O'Neill's definition does not give any insight to understanding insurgencies and why men and women become insurgents. By failing to explain to how insurgents use various means to achieve their objectives, his definition fails to reflect the broader scope and dynamic nature of insurgencies. It is clear that O'Neill's definition, and other similar definitions, is shaped by the Prussian military thinker Carl von Clausewitz's argument that "war is a continuation of politics by other means" (Clausewitz, 1832).

Even though O'Neill attempts to identify the deficiencies in American thinking in defining the term *insurgency*, the current Department of Defense Joint Publication (JP) 1-02, used in counterinsurgency doctrine, is still based on the dominant American thinking that insurgencies are revolutionary movements.   Hence, JP 1-02 defines the term *insurgency* as:

> An organized movement aimed at the overthrow of a constituted government through the use of subversion and armed conflict (Department of Defense, 2004).

In his paper, *The Basics of Counterinsurgency*, R. Scott Moore argues:

> This characterization has changed little over the past several decades, orients on military and security actions, and fails to reflect the wider scope and complexity of insurgencies today, especially their protracted and transnational nature and their political, economic, and social dimensions (Moore, 2007).

He further argues that this definition implies that insurgencies are predominately a military issue and, hence, cannot be applied to all insurgencies because it is too narrow in scope and does not give any insight to their complex nature.

Like Moore, Chris North argues in his article *Redefining Insurgency* that the JP 1-02 definition applies more to insurgencies in the twentieth century than to insurgencies in general.   During the twentieth century, insurgencies arose when "anti-colonial and communist movements were competing with sitting governments for political power" (North, 2008).

Unlike their predecessors, modern insurgencies are more sophisticated and state-like in nature. Insurgents are controlling "larger swaths of territory and expanding their military capability to the point that they could undertake larger operations" and are modeling their organizational structure after current successful business corporations (Metz, 2007b). Insurgencies are also adopting the same business practices as corporations, such as acquisitions and mergers, forming strategic partnerships, reorganizing for greater effectiveness and efficiency, advertising and creating brand identity, accumulating and expending capital, just to name a few (Metz, 2007a). These practices help insurgencies to "maximize desired effects while minimizing cost and risk" (Metz, 2007a). This new approach make insurgencies feel less pressured to achieve an overall victory. Instead, they desire to control the internal conflict by establishing themselves as a long-lasting opposition force. Thus, the current JP 1-02 definition of the term insurgency, according to North, is not relevant or applicable to the enemy we, as a nation, face today and expect to face in the future.

The 2007 *Army/Marine Counterinsurgency (COIN) Field Manual* (FM 3-24/MCWP 3-33.5) attempts to expand on the JP 1-02 definition by viewing an insurgency as:

> An organized movement aimed at the overthrow of a constituted government through the use of subversion and armed conflict…an organized, protracted politico-military struggle designed to weaken the control and legitimacy of an established government, occupying power, or other political authority while increasing insurgent control (Field Manual 3-24/Marine Corps Warfighting Publication 3-33.5, 2007).

Unlike JP 1-02, the FM 3-24/MCWP 3-33.5 definition views insurgencies as solely political and military driven. The reason why the FM 3-24/MCWP 3-33.5 definition only encompasses these two aspects of insurgencies is because the COIN manual is still based on the concepts of Mao developed in the 1930s and revolutionary warfare in the 1950s and 1960s.

After its success in China, Mao's strategy was adopted by many anti-colonial insurgencies, such as Vietnam, Algeria, and Malaya. Mao's guide to establishing a successful insurgency can be summarized in the following three phases (Hammes, 2004):

Phase I: Build political strength with limited military force.

Phase II: Consolidate control of base areas by using military force.

Phase III: Commit regular forces to fight existing government

According to John A. Nagl in his book *Learning to Eat Soup with a Knife: Counterinsurgency Lessons from Malaya and Vietnam*, all of these phases must be done simultaneously in order for the insurgents to undermine their government and win the support of the local populace (Nagl, 2005).

Furthermore, the COIN manual incorporates teachings from British expert Robert Thompson and the French officer David Galula who both studied revolutionary warfare from China to Vietnam. According to Frank G. Hoffman in his paper *Neo-Classical Counterinsurgency?,* decision makers and military leaders should be wary about implementing the FM 3-24/MCWP 3-33.5 definition because COIN classicists, like Thompson and Galula:

> …ignore the uniqueness of Maoist or colonial wars of national liberation, and over-generalize the principles that have been drawn from them (Hoffman, 2007).

The classicists try to merge the teachings of Mao and revolutionary warfare with the nature of the twenty-first century world "shaped by globalization and the spread of extremist ideologies" (Hoffman, 2007). Hoffman believes the insurgencies of today are vastly different from their predecessors. The factors motivating modern insurgencies do not follow the factors that motivated the revolutionary insurgencies. Some modern insurgencies, as mentioned by O'Neill, do not seek to overthrow their formal governments like revolutionary insurgencies. Some are motivated by economic and social issues that have no political objectives.

Because the COIN manual is based predominately on an outdated and dubious Maoist foundation, many military analysts are "calling for a substantive reconceptualization of much of the existing theory and doctrine" (Hoffman, 2007). British University scholar David Betz believes the manual does not provide the military with a framework for the training and education of soldiers and Marines in insurgent warfare. In his paper, *Land Forces and Future Warfare: Learning to Fight Wars*

Amongst the People, Betz writes:

> …while the new counterinsurgency field manual is thorough, serious, and stands in sharp contrast to the political rhetoric concerning the "War on Terror" of the last few years, it is not without failings, chief among them that it is pervaded by concepts drawn from Maoist-style People's Revolutionary Warfare, which is not the sort of insurgency now being faced (Betz, 2007).

Even though the FM 3-24/MCWP 3-33.5 definition of the term *insurgency* attempts to reflect the ideologies of globalization and its impact on modern insurgencies, it falls short in its definition of today's insurgency.

The current definition of the term in FM 3-24/MCWP 3-33.5 has greatly impacted the Army's COIN operations. In fact, United States Army Lieutenant Colonel Gian P. Gentile is disappointed with the Army focusing solely on COIN operations that is primarily based on the teachings in FM 3-24/MCWP 3-33.5. According to Gentile, the FM 3-24/MCWP 3-33.5 is based on several underlying assumptions. For example, Clausewitz teaches that a center of gravity is something to be discovered (Gentile, 2008). The FM 3-24/MCWP 3-33.5 teaches soldiers that people are the center of gravity in a COIN operation and can only be fought with a large contingent of boots on the ground. Gentile claims the "authors of FM 3-24/MCWP 3-33.5 have done the discovering for [soldiers]; [the Army] seem to be blindly obeying". The soldiers are now conditioned, as Gentile argues, to believe that all COIN operations require the use of force to achieve the mission objective. Gentile believes that the people may be the center of gravity for some insurgencies, but the use of force is not a requirement in quelling all insurgencies. This specific FM 3-24/MCWP 3-33.5 principle is of one of the many principles in the manual that is currently misguiding soldiers in how they perceive the best strategy in fighting insurgencies. It also proves, as Gentile states in his article *Listen to the Airman*, "how these assumptions have been turned into principles and then into immutable laws that cannot be challenged" (Gentile, 2008).

Because in his view the Army has become a "COIN-only force", Gentile is convinced that it has limited its ability to think outside of the box on strategy and operations. Thus, as Gentile indirectly suggests from his article, it is imperative that the FM 3-24/MCWP 3-33.5 and other literature on insurgent warfare provide a more

inclusive definition of the term *insurgency* if the United States wants to win the Global War on Terror. The definition needs to illustrate the changing environmental conditions of insurgent warfare. The currently accepted definitions do not effectively describe the complexity of this evolving type of warfare.

C. INSURGENCY REDEFINED

While academic scholars and defense organizations cannot agree on a suitable definition for the term *insurgency*, there have been frequent discussions of redefining it. Moore does not believe the source of the disparate interpretations and definitions of the term lies in the outdated American thinking that all insurgencies are revolutionary movements that can only be fought using military force. Instead, he believes that the term is used synonymously with other terms that have vague meaning.

For example, Moore states the term *insurgency* is used interchangeably and imprecisely with "*irregular warfare, unconventional warfare, revolutionary warfare, guerrilla warfare* and even *terrorism*" (Moore, 2007). He agrees that most insurgency groups or movements engage in some or all of the above types of operations to achieve their mission objectives. Although each of these terms denotes a distinct type of conflict or military strategy, Moore argues that they do not define insurgency as a whole.

For example, *guerrilla warfare* encompasses a wide range of military operations, including *irregular warfare*. On the other hand, an *insurgency* may engage in *guerrilla* and *revolutionary warfare* tactics. Because the term *insurgency* is used loosely, Moore's paper explains how quickly this term can create confusion. A clear, precise definition of the term is necessary.

Moore characterizes an insurgency as a group that "seeks radical change" of the "existing political or social order" through the use of violence and political upheaval (Moore, 2007). It employs terrorism as a means to achieve its objectives. Terrorism is not, however, the primary focus of insurgent movements. Insurgencies focus more on their country's political, economic and social elements which, Moore explains, are at the "heart of the conflict, both its causes and its effects" (Moore, 2007). Based on his understanding of insurgencies, Moore offers the following expanded and refined definition of the term:

An insurgency is a protracted violent conflict in which one or more groups seek to overthrow or fundamentally change the political or social order in a state or region through the use of sustained violence, subversion, social disruption, and political action (Moore, 2007).

Moore's definition "reflects the multi-faceted character of insurgency" by including their violent, political and social aspects. His definition proves to be more powerful, yet succinct, than the currently accepted definition used by the Department of Defense and other academic scholars (Moore, 2007). Moore's revised definition portrays the nature and scope of insurgencies in the twenty-first century. For these reasons, this thesis uses Moore's definition as a basis to develop a unified general framework of insurgency.

Using Moore's definition, this thesis attempts to answer Steven Metz's question, mentioned in his 2007 monograph *Rethinking Insurgency*, *how should we rethink insurgencies*? Metz believes the first step in tackling this problem is urging military leaders and decision makers to steer away from the old American conceptualization of insurgencies and see them more as "complex internal conflicts of the 1990s than the insurgencies of the mid-20th century" (Metz, 2007b). After accomplishing this task, Hoffman recommends they start "rebuilding [their] mental model of [insurgencies]" by urging military planners to "continually develop innovative and culturally effective approaches" that can further their understanding of this evolving type of warfare. A new mental model and approach to understanding and describing insurgencies can more fully prepare the United States military for future engagements in insurgent warfare.

Several insurgency experts and scholars—Jeffrey White, David Kilcullen, Brian Reed, Mark D. Drapeau, Peyton C. Hurley, and Robert E. Armstrong—each have provided an alternative approach to describing and understanding insurgencies that is rooted in a specific discipline or field of study. The terminology used in each approach would have decision makers, military leaders and insurgency experts speaking the same language. The next section discusses each alternative approach and how each attempt to "rethink" the insurgency issue, as recommended by Metz.

D. ALTERNATIVE APPROACHES TO DESCRIBING INSURGENCY

Four currently explored approaches in describing and understanding insurgencies are: 1) social networks; 2) sociobiology; 3) ecology; and 4) complex adaptive systems. This section does not compare or contrast these four approaches. Instead, this section discusses each existing approach and highlights each author's main arguments to persuade decision makers and military leaders to take a fresh approach "rethinking" insurgencies. The brief review of existing approaches to understanding insurgency movements' reveals a number of significant shortcomings. Considered together, these shortcomings suggest the need for a deeper and more fundamental framework for describing the insurgency movement. This section first looks at the social networks, and then guides the reader through the other three approaches, showing how they have evolved into complex systems.

1. Social Networks

The most commonly used approach to analyzing insurgencies is reflected in various studies that have employed social network methods to identify relevant linkages among the members within the organization. The social network method (related to network theory and also called Link Analysis) attempts to construct and then analyze mathematically a network diagram consisting of nodes and arcs that link individuals and organizations in socially meaningful ways. Figure 1 is an example of a social network diagram of a narcotic distribution ring. This approach helps those involved with interdiction operations to identify and document major power players as well as small-time dealers within a drug distribution ring.
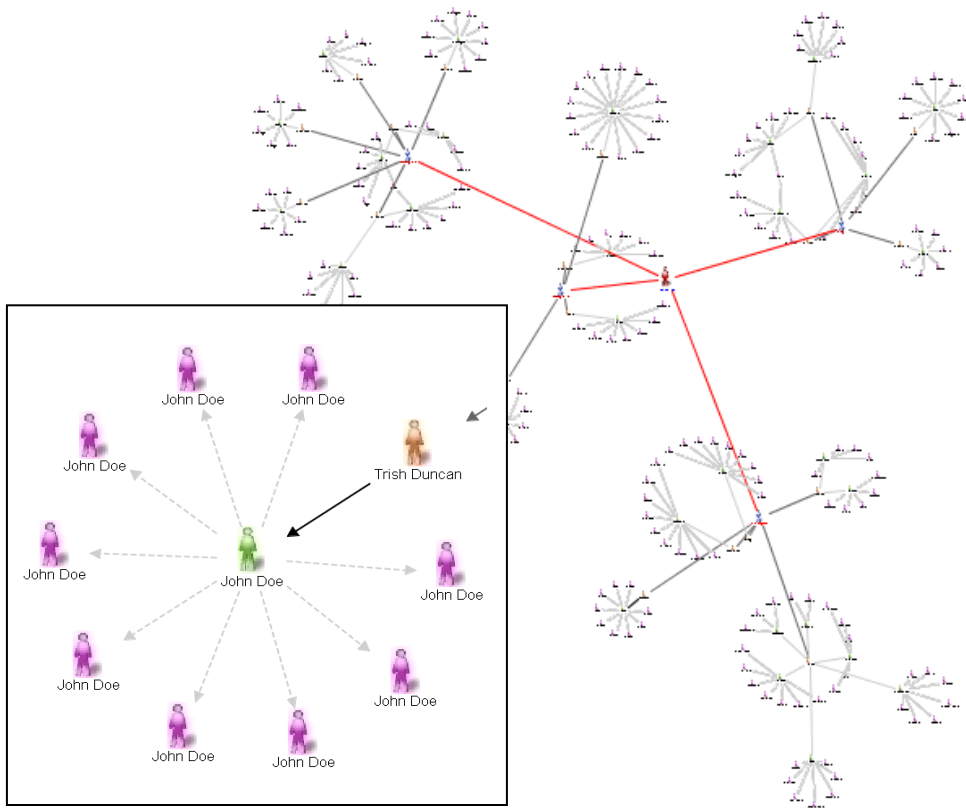
Figure 1.   Social Network Diagram for a Drug Distribution Ring (Sawyer, 2008).

Social networks are based on two primary premises: 1) the networks operate on many levels, from families up to the level of nations; and 2) the network itself plays a critical role in determining the way problems are solved, organizations are run, and the degree to which individuals succeed in achieving their goals. These two premises not only show how a social network approach appears as a natural fit to describing a drug distribution ring, but also for describing the insurgency movement.

According to Brian Reed in his article *A Social Network Approach to Understanding an Insurgency*, a social network approach is very applicable to the insurgencies being fought in the current Global War on Terrorism, specifically the operations in Afghanistan and Iraq. It is not uncommon to read in articles on insurgencies that they are "organized as a network" (Reed, 2007). Because insurgencies are sophisticated network organizations, Reed claims that the social network approach "permits a more complete understanding" of these type of networks and how their "behavior is affected by connectivity" (Reed, 2007).

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For example, the social network approach is currently being used to formulate strategies to counter the Iraqi insurgent network. Using this approach to analyze available intelligence data regarding how well the insurgents are fighting as well as their strengths and weaknesses, the United States Military's Intelligence Preparation Battlefield (IPB) command can effectively assist ground commanders in "identifying targets, objectives, and friendly tactics" (Reed, 2007). The military analysts assigned to this command are constantly creating social network diagrams that illustrate how the insurgency is interconnected with "other groups throughout the state, region, or world" (Reed, 2007). Social network diagramming of insurgent cells and their connections to other insurgent organizations is a key component in furthering ground commanders' understanding of the enemy they face.

Thus, Reed strongly recommends that a social network approach be used to "rethink" insurgencies because of its timely use in today's military operations. By employing this approach, military analysts will be able to specify in more exact terms an organization's relationships by, as Reed states:

> …showing exactly what type of network design is being used; when and how members might act; where the leadership resides; and how hierarchical dynamics may be integrated with network systems…identify and portray the details of a network's structure, as they traditionally do when charting an adversary's leadership, especially if they are analyzing terrorist and criminal organizations (Reed, 2007).

Social networks give analysts a fundamental understanding of the insurgent organization and, from the diagrams, as seen above, provides inferences to how the insurgency fights and what it looks like. Reed advocates that the social network approach is better than most conventional analytical approaches that only employ "organization charts" to illustrate the insurgent network because it takes the analysis of insurgent networks one step further by identifying both its structural classification and critical nodes. It even addresses the power distribution in the insurgent organization.

According to Reed, the division of labor in an insurgent organization creates subunits and differentiated roles. Each subunit develops specialized interest and responsibilities. Depending on how important the subunit is within the organization, it can have more control over the organization's resources, more success, and more

connections with "individuals who influence the allocation of resources" (Reed, 2007). If a subunit has all of these attributes it is considered to be a powerful asset to the organization. With power comes knowledge, as Reed highlights in his paper,

> People who are well placed in the communication networks tend to be the central players in terms of power and influence. Consequently, we can determine that power is a function of one's position in the network of communications and social relations. Certainly, this is true when a position is assessed in terms of structural centrality and the power of the people with whom one is connected (Reed, 2007).

Being able to identify the power distribution within the insurgent network, Reed argues that the military analyst can determine the best attack strategy to disrupt information flow and decision making within the network, thus destabilizing the insurgency's operations and diminishing its effectiveness.

Even though Reed believes a social network approach gives decision makers and military leaders an "understanding of how [insurgencies] conduct [their] operations", there are a few shortcomings of this approach as a method for analyzing insurgencies. According to Dennis Leedom in his research paper, *Work-Centered Approach to Unit Insurgency Analysis*, he believes the social network approach "emphasizes organizational structure over organizational purpose and functioning" and its methodology "presumes that an understanding of purpose and functioning can be derived from an identified structure" (Leedom, 2007). Insurgencies do not establish an organizational structure at first; instead they begin with a purpose and later establish an adaptive structure over time to achieve their purpose.

Because insurgencies are established with a specific purpose and then function, their networks are even harder to interdict. According to John Robb in his article *Destabilizing Terrorist Networks* there is mounting evidence that clearly indicates that "insurgent networks are not susceptible to disruption in a traditional organization sense" (Robb, 2004). Robb argues analysts should not apply the social network approach to insurgencies because their networks violate the two premises of the approach, as discussed above, and for the following three reasons: 1) insurgent networks have many "emergent" leaders that quickly ascend when other leaders are removed, often through pre-existing latent connections that are "turned on" as needed; 2) insurgent networks are

composed of a meta-matrix of networks for information transfer, knowledge sharing, task completion, and so forth; and 3) they are dynamic in nature (Robb, 2004). Furthermore, Robb argues that the relationships within an insurgent network do not reflect the hierarchical relationships. Rather they are, as Robb defends:

> …based on panoply of factors that are constantly changing; therefore, the structure of the network is in constant flux in response to learning and adaptation by the individual nodes (Robb, 2004).

Thus, in order to properly analyze insurgencies, Leedom recommends that analysts "must begin with an understanding of purpose and functioning" and then "move toward the inference and verification of organizational structure" (Leedom, 2007).

2. Sociobiology

Sociobiology primarily draws on concepts from biology and sociology and other disciplines ranging from anthropology to zoology. It explains how behaviors evolve over time and analyzes natural selection and its affect on social behavior in all living species, particularly humans. Living species only "act in ways that have proven to be evolutionary successful over time" (Wikipedia, 2007). They are able to do this because of two fundamental premises in sociobiology: 1) certain behavioral traits are inherited; and 2) inherited behavioral or adaptive traits are honed by natural selection (Wikipedia, 2007).

Jeffery White attempts to extract these sociobiology concepts in understanding the Iraqi insurgency in his 2006 paper, *An Adaptive Insurgency Confronting Adversary Networks in Iraq*. White begins his analysis by presenting his view of insurgencies as adaptive "'network of networks' consisting of multiple interconnected insurgent organizations with several origins, varied natures, and diverse goals" (White, 2006). He comments on how scholars, analysts and military operators working on the Iraqi insurgency are using terms, such as "combat Darwinism", "adaptive insurgents", and "learning opponents", to describe the insurgency. Whether they are aware of it or not, White states that these professionals are using sociobiology concepts.

White understands sociobiology is a controversial discipline, yet he defends that its concepts shed light on why the United States military have so far failed to combat and

contain the insurgency as the insurgency continues to grow and survive in a hostile environment. White argues that sociobiology concepts provide an adequate vocabulary that gives "many useful analogies for the insurgency" (White, 2006). He believes that the sociobiology terminology can aid decision makers and military leaders in understanding the adaptability of the insurgency through its adaptive networks and provides a useful tool in examining and dissecting its dynamic behavior.

White does not advocate defeating insurgencies, but controlling them. His underlying message is that insurgencies can be controlled if their operational environment is drastically changed such that they have little capability to adapt to their new environment. Being able to contain an insurgency shifts power from the insurgents to the counterinsurgents. In order for the power shift to occur, White claims military strategists must understand how the insurgency learns about changes in its environment and what their adaptive capacity is if the environment is changed. If the counterinsurgents can control or limit an insurgency's operations, the organization will eventually cease to exist due to its inability to expand or mobilize internal and external support.

To further this fundamental understanding, White explores the following four elements—the kinship system, the terrorist and foreign fighter groups, the underground and visible Shiite networks, and their expanded network—and how they each contribute to the adaptability of the Iraqi networks. These four elements also determine behavior of the insurgency. The most critical of the four elements underlying the Iraqi insurgent network is the kinship system, which is based on tribal, clan and family ties. In addition to a number of social factors, including association, religion, criminal enterprises, and local and neighborhood associations, the Iraqi culture is built on kinship, thus deriving a precise characterization of each of these social factors can be difficult. White recommends analyzing the traits that contribute to the insurgency's success, such as its structure, nature, identity, purpose, function, scope, knowledge, skills, abilities, membership and recruitment base, resources and adaptability to arrive at a more precise characterization. These traits predict the fitness of the insurgency, in other words, "how well suited or adapted a given network is to survive in the Iraqi environment" (White, 2006).

Lastly, White analyzes the strengths and weaknesses of insurgencies that determine how vulnerable and invulnerable they are to attack. In particular, he addresses three inherent strengths of insurgencies: 1) their protective measures; 2) the diversity of their networks; and 3) their behaviors. When analyzing how insurgencies protect themselves from counterinsurgent attack, White uses sociobiology terminology, such as "protective coloration", "replacement", and "impenetrability" and "cells" to describe their capabilities. In his paper, White defines these terms as follows: "protective coloration" as the ability of an insurgency's network to "blend into the environment"; "replacement" as the measure of how quickly the insurgency can rebound after having "individuals or functions eliminated or disrupted by coalition action"; "impenetrability" as the insurgency relying on its tight networks, such as kinship, religion, and its members, to disallow counterinsurgents and their informants from acquiring intelligence on organization's internal operations; and "cells" as the lowest level (building blocks) within insurgencies that are always under attack (White, 2006).

The cells have to use "protective coloration", "replacement", and "impenetrability" in order to deceive the counterinsurgents and withstand their many attacks. The other two inherent strengths, diversity and specific behaviors, contribute to an insurgent network's overall adaptive capability. This can be seen in an insurgency's internal and external network. Some networks are family or tribal based while others are formed among the insurgents and their leaders. The Iraqi insurgency networks, for example, are highly connected internally to the social structure of the country. By having this diverse network, the insurgency can, as White writes:

> …cooperate significantly on both the military and the political fronts, combining for joint operations and disseminating political and operational directions under joint authorship (White, 2006).

White argues this set of inherent strengths can predict specific behaviors that make the insurgency's networks vulnerable to attack. In fact, White uses another set of sociobiology terminology, such as "competition", "connectivity", "inadaptability", "contradiction", and "self-interest" to describe the behaviors that cause insurgencies to be easily attacked by counterinsurgents. These behaviors are potentially exploitable by counterinsurgents.

Even though White believes sociobiology concepts illuminate important aspects of the insurgency and eliminate the need for providing warfare details, such as the number of arms, manpower and equipment, there are a few shortcomings to this approach as a method for analyzing insurgencies. As mentioned previously, sociobiology studies the behavior of living species. Sociobiology concepts can be helpful in understanding insurgencies only if it is applied to understanding the insurgent networks. All the internal and external insurgent networks are based on human relationships and interactions. Because their traits and evolving behavior can be easily traced, predictions of future insurgent behavior can be made. However, the traits alone do not predict the insurgency's behavior. Other aspects, such as resources and other forms of external and internal support can have a huge impact on the insurgent system. These additional features can determine the level of stability within the insurgency. White does not provide a large enough vocabulary to take into account this dynamic within the insurgent system.

White limits his discussion and approach by only analyzing two elements: the insurgent network and its operational environment. His approach implies that one of these two elements is dependent on the other. In other words, every change in action in the operational environment triggers a specific reaction by the insurgent network, thus showing its adaptability. A strategist cannot make any additional inferences outside of the insurgency's adaptive capabilities from this limited observation. The sociobiology approach fails to answer directly how the insurgent network learns about changes in its environment or how the insurgent networks interact with each other. According to his discussion, one could guess or assume that the kinship system is the primary provider for the insurgency while in hiding. The secret servants of the insurgency learn about the environment, in this case, the counterinsurgent operations, and then relay that information back to the insurgents in order for them to plan their next wave of attacks against the enemy. However, White's approach does not explicitly describe this phenomenon.

3.   **Ecology**

In their paper, *So Many Zebras, So Little Time: Ecological Models and Counterinsurgency Operations*, Drapeau, Hurley, and Armstrong investigate models of

the interaction of insurgents and counterinsurgent forces using ideas and models from the subfield of biology called ecology, evolution, and animal behavior. They hypothesize that "biology is more than a laboratory science; it is a way of thinking about the natural world". And, thus "thinking like a biologist" can provide insight about insurgent warfare. They examine a sequence of increasingly complex species interaction models and for each develop the insurgent analogy and evaluate whether the assumptions of the biology models were closely enough met to allow their use to model insurgencies.

They first look at simple predator-prey models used, for example, to study Lion-Zebra and Wolf-Deer interactions over time. They model the insurgents as prey and the counterinsurgent forces as predators and identified mechanisms that prey use to avoid extinction, such as "decreasing local prey density", "increasing 'handling time'", and "occupying territory within which predators cannot hunt". These are similar to insurgent behaviors. The predator-prey interactions are modeled as differential equations that are commonly referred to as the Lotka-Volterra model. After suitable parameters have been specified, these equations can be solved to determine if the prey will become extinct or long term equilibrium will be achieved. After examining the assumptions underlying these models, the authors conclude that they were "too simplistic" to describe insurgency conflict.

The authors next look at differential equation completion models that involve the interaction of two or more species fighting for a limited resource. These models may be "exploitation competitive" where the species do not attack each other or "interference competitive" where species attack each other's ability to obtain the resource. They modeled the population (those people not insurgent or counterinsurgent) as the scarce resource to be completed for. There are more complex biological models that allow the prey to attack the predator. The authors note that additional factors need to be added or modified to make the model of the insurgency more realistic. They did not develop a more complete insurgency model; they conclude that other ecological models were more promising.

The authors then investigate species interaction models that use game theory or adaptive dynamics, or both. They describe a model using a game theoretic decision tree

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that describes different states that individuals can be at any time. This structure allows the modeler to develop a "payoff function" which can then be maximized. The authors conclude that:

> Adaptive dynamic models, in the end, can offer predictions about the best strategies for providing the highest payoff when facing an opponent in a game who is expected to play a number of strategies with certain probabilities (Drapeau et al., 2008).

The authors conclude with a discussion of other limitations on the use of ecology models to study insurgencies. These include: 1) "scale dependence" and "density dependence" that involve the scale of the activity being studies (village, city, or nation); 2) "asymmetric of support" because the competing forces need differing levels of population support to be successful; and 3) "means versus will" which involves measuring the political will to keep fighting.

A striking point of the paper is a careful study of the assumptions underlying the ecological models and specification of critical aspects of insurgencies that maybe critical to a modeling effort. However, the authors did not develop any insurgent model to a point where parameters were specified and calculations performed. Thus, it is not possible to evaluate the usefulness of the insurgent models that were suggested.

4.   Complex Adaptive Systems

David Kilcullen is an expert on counterinsurgency; he has a PhD in the political anthropology of insurgency and he served twenty-one years in the Australian Army specializing in counterinsurgency and unconventional warfare. He is an advisor to the United States military and State Department. In his paper, *Countering Global Insurgency*, he argues that the "War on Terrorism" is best understood as a global insurgency. He believes that classical counterinsurgency developed in the last century will not work—it will be necessary to have "a fundamental reappraisal of counterinsurgency" (Kilcullen, 2005). The paper then argues for a "strategy of 'disaggregation' that seeks to dismantle, or de-link Global Jihad" (Kilcullen, 2005).

Kilcullen's paper also discusses how complexity science, in particular "organic systems" and complex adaptive systems, can be used to model insurgencies and thus guide the analysis of counterinsurgent operations. He argues that a systems approach

should be used to study insurgencies, but the systems analysis approach used during the Vietnam War is not capable of handling the complexity of insurgencies because it takes a "Cartesian, reductionist" approach (Kilcullen, 2005). He believes the "emerging science of complexity" may provide new tools and a new approach.

As described by Kilcullen, complexity theory shows that social systems and insurgencies are "organic systems" that share characteristics with other living systems. Further, organic systems are complex and adaptive in their environment. He then notes that:

> Importantly, the argument is not that insurgencies are like organic systems, or that organic systems are useful analogies for understanding insurgency. Rather, the argument is that insurgencies are organic systems, in which individual humans and organizational structures function like organisms and cell structures in other organic systems (Kilcullen, 2005).

He then lists and discusses seven features of insurgencies that come from viewing them as organic systems. Some of these come from systems theory, some from biology and some from the field of Complex Adaptive Systems (below we note that references to Complex Adaptive Systems features is problematic). He then lists seven elements of the insurgent system. From these elements he develops the biological model shown below in Figure 2.

Figure 3
Model of an Insurgency as a Biological System

OUTPUTS
- Casualties, physical/economic damage
- Climate of fear and insecurity
- Propaganda / media coverage
- Further grievances / Social dislocation
- Doctrine / developing techniques

Incidents / Attacks
Popular support   BOUNDARY
Territorial control   INTERACTIONS
Intelligence and situation awareness
Information Dominance & Media
Economic dominance
Freedom of Movement
Loss Exchange Ratio in contacts

- People (recruits, supporters, specialists, leaders)
- Materiel
- Ideology/Culture
- Grievances
- Money
- Doctrine / techniques

INPUTS

LEGEND
● Node (unit, cell, individual)
— Link (pattern of interaction)
--- Organisational boundary with environment
◆ Boundary interaction

Figure 2.   Kilcullen's Biological Model of Insurgency (Kilcullen, 2005).

Based on this figure, he identifies seven ways to attack insurgencies and then discusses five insurgencies of the late twentieth and early twenty-first century and lists the types of attacks used in each.

Appendix C of (Kilcullen, 2005) provides a systems dynamic description of the Iraq Sunni Insurgency (Forrester, 1961). This includes five feedback loops, one control loop and a diagram of the interactions of the loops. As he notes:

> …this is not intended as an exhaustive analysis of the Iraq Insurgency, rather as an illustration that systems assessment can produce fresh insights into an insurgency" (Kilcullen, 2005).

This analysis goes a step beyond the work of Drapeau, Hurley, and Armstrong described in the previous section by specifying the factors in each loop. Kilcullen's

detailed understanding of the Iraq Insurgency allows him to include significant details that yield insights. The next step in a system dynamics analysis, which he chose not to take, would be to assign parameters and compute the interactions of the loops over time. As with the work of Drapeau, Hurley, and Armstrong it is not clear that enough details about the insurgency and its processes are available to gain any insight from executing models of this type. Further, the adaptive nature of an insurgency, the counterinsurgency, and the population provides too many variables to capture in a simple model. Thus, Kilcullen used the systems dynamics model as a descriptive model rather than as an explanatory model.

Kilcullen is an expert in insurgencies and his biological model of insurgencies yields some insights on the nature of insurgencies and how they might be attacked. His analysis of insurgencies as organic systems is in spirit and in some details related to the insurgency framework developed here. Unfortunately, while the model and the discussion surrounding his model contain many important biological concepts the result is not a complete biological model. More importantly, his definition of "Complex Adaptive System" is not in agreement with the most common use of the term. Also some of the terms that he uses from the Complex Adaptive Systems literature, such as *non-equilibrium*, *dissipative structures*, *fractal-like*, *critical mass*, and *edge of chaos* are used to describe and analyze systems that exhibit disorganized complexity, which insurgencies do not (Alderson, 2008). With all other living systems, insurgencies exhibit organized complexity.

E. SUMMARY

In professional military publications and the insurgency literature, there are large disparities in how insurgency is viewed and defined. Moore attempts to bridge the gap by redefining the definition to reflect the nature of the twentieth century insurgency. According to Metz, redefining the term is imperative. However, it is much more important that military leaders and decision makers spend more time rethinking their current approach in describing insurgencies. Metz urges insurgency experts and scholars to rethink insurgencies using approaches from various scientific disciplines. Each

approach provides terminology that is intended to have military leaders and decision makers speaking the same language. However, the terminology is vague and commonly confused with terms found in other scientific disciplines. This major shortcoming gives support to the use of James Miller's Living Systems Theory as another approach to describing insurgencies. The next Chapter goes into detail discussing the major concepts of Miller's Living Systems Theory as an alternative approach to the rethinking of the term insurgency using carefully defined terms and explanations.

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III. MILLER'S BACKGROUND AND LIVING SYSTEMS THEORY

A. OVERVIEW

James Grier Miller's Living Systems Theory is a general theory about how all living systems are structured and how they work. The theory analyzes system processes, structures, interactions, behaviors, development and maintenance exhibited in all living systems. It gives a detailed methodology for handling complex interrelationships and changes which occur in living systems. It also focuses on concrete systems, which Miller defines as "non random accumulations of matter-energy in a region in physical space-time, which is organized into interacting, interrelated subsystems or components" (Miller, 1995). Unlike the approaches mentioned in the previous chapter, Miller's theory provides a new terminology and an alternative approach to the rethinking of the term *insurgency* that encompasses various disciplines, including biology, physics, chemistry, and the social sciences. Many academic scholars and experts have proposed insurgencies be viewed as systems, but none have viewed insurgencies as living systems. This thesis provides not only an alternative approach to the understanding and rethinking of the term *insurgency* by applying Miller's Living Systems Theory, but describes and shows how insurgencies share similar characteristics, such as inputs, outputs and processes, with other living systems.

Before adopting Miller's Living Systems Theory to describing insurgencies, it is imperative to give an overview of Miller's background explaining why he devoted his entire career to constructing an interdisciplinary theory describing system behavior and to give a detailed discussion of the major concepts in his theory. This chapter discusses six things: 1) the historical background of Miller's work; 2) the legacy of his book *Living Systems*; 3) the three major concepts discussed in Living Systems Theory; 4) the definition of the term *living system*; 5) the properties associated with this type of system; and 6) the characteristics of the eight levels outlined by Miller's theory, using general insurgency examples.

B.   HISTORICAL BACKGROUND OF JAMES MILLER

Miller's interest in biological and social sciences can be traced back to his undergraduate days at Harvard University from 1934-1938. While at Harvard, Miller's mentor Alfred North Whitehead, a professor in the Department of Philosophy and Psychology, suggested to Miller that he make a serious attempt to develop a theory that merge concepts from various biological and social sciences dealing with mankind and other living beings. Whitehead's suggestion came during a time when Cambridge University professors Sir Arthur S. Eddington and Sir James H. Jeans were both working on theories that would encompass various scientific disciplines to explain the physical universe. Miller, intrigued by Eddington and Jeans' work, decided to work closely under Whitehead while he taught psychology at Cambridge Junior College in 1938.

Later that year, Whitehead appointed Miller as a Junior Fellow in the Harvard Society of Fellows because of his research and significant contributions in psychology. In the next decade, Miller earned a Masters and PhD in psychology, a M.D. degree, served two years during World War II in the Army, and served two years as a section chief at the Veterans Administration. In 1948, at the age of 32, he was appointed professor and chairman of the Psychology Department at the University of Chicago. In 1949, Miller joined the faculty research club called the Innominate Club at the University of Chicago. Nuclear physicist, University of Chicago professor and Innominate Club member Enrico Fermi, strongly urged Miller to work with other professors at the University to develop an integration of biological and social scientific knowledge about life. Fermi felt it was imperative to have an interdisciplinary theory for the survival of the human race during a time of nuclear arms development. He hoped that this type of theory might lead to a better understanding of human behavior while preventing humans from destroying themselves by nuclear warfare. Even though Miller expressed skepticism over Fermi's suggestion for him to construct a general theory of life that encompasses both biological and social sciences, he still was intrigued by Fermi's idea.

Once Miller agreed to undertake the project, Fermi provided funding for him to establish an interdisciplinary group of senior professors that would investigate "…whether a sufficient body of facts exists to justify developing an empirically testable

general theory of behavior" (Swanson, 2007). Miller was instrumental in the formation of his new interdisciplinary group, which he called the Committee on the Behavioral Sciences. Miller's committee included professors ranging from historians, anthropologists and economists to political scientists, doctors of medicine and mathematical biologists. In the mid 1950s, Miller and several of his colleagues moved to the University of Michigan to form the Mental Health Research Institution (MHRI), which was under Miller's direction. He was President of the University of Louisville from 1973-1980. Emerging from MHRI were numerous scholarly contributions, including Miller's book *Living Systems*, which was published by McGraw-Hill in 1978.

C. THE LEGACY OF *LIVING SYSTEMS*

Miller spent over 25 years, with the help of his wife, to complete the first edition of his book. The book's thesis is based on the following idea that:

> ..systems at all levels are open systems composed of subsystems which process inputs, throughputs, and outputs of various forms of matter, energy, and information (Miller, 1995).

Miller collected over three thousand scientific articles in support of his thesis. Within the first edition of *Living Systems*, Miller explains his advanced conceptual framework of Living Systems Theory. Miller notes that "living systems can be as simple as a single cell or as complex as a supranational organization, such as the European Economic Community" (Parent, 1996). In the original version of his book, Miller identifies seven nested hierarchical levels that exist in complex systems. He defines the term *level* as a "hierarchy of systems" (Miller, 1995). Several years later, Miller adds an eighth level, which results in the following revised hierarchy: 1) cells; 2) organs (composed of cells); 3) organisms (independent life forms); 4) groups (families, committees, work groups); 5) organizations (communities, cities, corporations, universities, multinational corporations); 6) communities; 7) societies (nations); and 8) supranational system.

Miller was able to construct this hierarchy based on his knowledge of evolution. Since the creation of cells over three billion years ago, Miller believed the general direction of evolution was growing more increasingly complex into supranational systems. However, in his book, Miller states that he only distinguishes eight levels of

living systems for analysis, but does not conclude that there are exactly these eight levels of living systems; there could be more and the hierarchy could be categorized differently. Regardless of the number of levels of living systems, all levels share the same five characteristics, which will be discussed in further detail in this chapter.

Because *Living Systems* is a general theory of living systems, Miller intended his book to be read by the general public as well as by scientific specialists. Most importantly, he wanted his theory to be applied to everyday life. Miller's Living Systems Theory has been applied to various sectors including the military and marketing. For example, in his thesis, *An Application of Living Systems Theory to Combat Models*, Raymond R. Crawford proposes the military, in particular the Army, to use Miller's theory as a "systems framework for incorporating organization aspects in combat models" (Crawford, 1981). According to Crawford, decision makers use combat models to plan and predict future needs of the military as well as describe the processes of battle and wars. They also use these models to study new warfare technology. However, the combat models fail to show how the new technology affects the military organization. Military analysts, as Crawford claims, have difficulty in modeling "organizational aspects in a logical and systematic manner" (Crawford, 1981). Thus, Crawford strongly recommends military analysts apply Miller's theory to their combat models because it "adds realism and quantification of processes that are critical to the organization in combat" (Crawford, 1981).

Like Crawford, R. Eric Reidenbach and Terence A. Oliva use Miller's Living Systems Theory as a holistic and flexible framework for analyzing marketing phenomena. In their paper *General Living Systems Theory and Marketing: A Framework for Analysis*, both authors point out that marketing science has always been seeking a framework that provides better tools for analyzing the facts of marketing and assisting in asking the right questions about marketing phenomena (Oliva et al., 1981). The failure to develop such a framework is due to the high focus on marketing practice rather than on marketing theory. Marketing practice, as both authors believe, helps annunciate ideas. However, it does not separate marketing functions from other functions, such as accounting and management, and falls short of providing a "more comprehensive

theoretical analysis, which is becoming critically necessary in our increasingly complex world" (Oliva et al., 1981). Thus, the authors are convinced that Miller's Living Systems Theory offers the best "analytical framework to start an integrated attempt at analyzing the marketing function and hence, move toward a true theory of marketing" (Oliva et al., 1981).

In summary, the purpose of Miller's book *Living Systems* is summarized in the following four points: 1) to show that a general theory of living systems can be constructed; 2) to assemble facts (from many relevant researches) and reveal how they support a set of unifying scientific principles; 3) to point out gaps in current knowledge that need to be filled; and 4) to present scientific methods for studying and comparing various sorts of living systems. In order to apply the Living Systems Theory presented in his book, Miller makes it very clear that one must first understand the three central concepts of his theory: 1) space and time; 2) matter and energy; and 3) information.

D.   THREE CENTRAL CONCEPTS

According to Miller, the concepts of "space", "time", "matter", "energy", and "information" are essential to his theory. All living systems attain information from their operational space by the use of matter and energy and all of their actions are dependent on the time they receive the information from their operating space. Miller's theory indicates these concepts do not alone predict whether a living system will survive in its environment. This section defines and highlights the properties associated with "space", "time", "matter", "energy", and "information" in all living systems.

1.   Space and Time

Miller defines the term *space* as a "set of elements which conform to certain postulates" (Miller, 1995). A system may exist in two sorts of spaces, physical (or geographical) space and conceptual (or abstract) space. Some systems exist and operate in a physical space, or a common space that is well known to them. However, this physical space is subject to various constraints that can affect the action of the subjects within the system. For example, insurgents interact more with persons who live near to them than with persons who live far away. This physical constraint limits the number of

citizens that insurgents can trust to keep their actions secret. These physical spaces can be further constrained by changes within the space due to war, weather, industrialization, just to name a few. Many insurgencies are conditioned to operate in a dangerous environment. Their country's landscape is constantly changing due to waves of attacks by the counterinsurgents. The insurgents are limited to how they operate in their physical space. However, the physical space constraint gives insurgents an advantage over the counterinsurgents that are typically not use to operating under harsh conditions. Every insurgency will operate in a different geographical space. Some insurgencies are located in countries that are landlocked, like Iraq, or countries that are on an island, like the Philippines.

In addition to the physical and geographic spaces, some systems operate in a conceptual and abstract space. Unlike physical and geographic spaces, conceptual and abstracted spaces are subject to different constraints. These spaces are influenced by human interpretation. In other words, humans will vary on how they interpret the "meaning of such spaces, observing relations, and measuring distances" (Miller, 1995). For example, senior military leaders and analysts have different interpretations on how they view the structure of an insurgency. Many describe the structure of an insurgency as a network. Even though there may be different interpretations of insurgencies, the conceptual and abstract spaces in which they exist can be useful in recognizing that the "physical space is not a major determinant of certain processes" within them. For example, local citizens and foreign fighters join insurgencies because they all share similar interests and attitudes towards the counterinsurgent forces, regardless of how far apart their hometowns are.

In regards to the issue of time, Miller considers this element of all systems as the "fourth dimension". Miller defines the term *time* as the "particular instant at which a structure exists or a process occurs, or the measured or measurable period over which a structure endures or a process continues" (Miller, 1995). All systems are free to move in any direction. However, the direction they choose to follow cannot be reversed.

2. Matter and Energy

Miller defines the term *matter* as "anything which has mass and occupies physical space" and *energy* as "the ability to do work" (Miller, 1995). He uses the term *matter-energy* because he believes the two properties have an inseparable relationship—systems sustain themselves by ingesting matter and converting it to energy. According to Miller, matter-energy is the "food" or inputs of the system. Matter-energy helps a system function, perform processes and regulate entropy levels. If a system is unable to import matter-energy across its boundaries, it will turn chaotic and cease to exist. As a result, the entropy level within the system will increase, causing the system to lean towards more disorder, while the entropy level outside the system will decrease, causing the physical universe to lean towards less disorder. Shifting the disorder within the system will impact its functioning capability. All systems must stay in equilibrium.

3. Information

For Miller, the term *information* means "the degree of freedom that exists in a given situation to choose among signals, symbols, messages, or patterns to be transmitted" (Miller, 1995). Information may be of several types from which the system must find meaning. Miller defines "meaning" as the significance, or the usefulness, a given system places on information. In this context, information literally means to bring into form. Thus, information directs a system in its use of matter-energy. The information selected determines what a system will do with the input, how it will be processed, and what its output will be.

E. LIVING SYSTEM DEFINED

Again, the above central concepts are the heart of Miller's theory. The next essential concept of Miller's theory is the term *living system*. A living system is defined as an open, self-organizing system that "exists in space and is made of matter and energy organized by information" (Miller, 1995). Living systems are open systems that need both living and non-living matter from their environment in order to survive. They have very selective boundaries. Matter, or inputs, that permeate the system's boundary go through a series of processes, which Miller defines as a change over time of matter

converted into energy or information in a system (Miller, 1995). Any remaining inputs not immediately used are either stored within the system for future use or processed as an output transmitted out of the system and into the environment.

Living systems are composed of a large number of self-organized subsystems, which Miller defines as "structures in a system which carry out a particular process" (Miller, 1995). The subsystems lack either the communication abilities or the computational abilities, or both, that are needed to implement centralized control, and the constantly adjusting nature of the subsystems activities that depends on the basis of limited, local information (Seeley, 2002). These two characteristics prove that a self-organizing system can only operate with centralized planning or control. Hence, the subsystems in a living system must cooperate closely for the effective functioning of the system as a whole.

Living systems are not only described as open and self-organizing but using the three fundamental concepts discussed in the previous section as building blocks. A living system can be described as using one of the following three kinds of systems: 1) conceptual; 2) concrete; 3) and abstract systems. A conceptual system is comprised of non-physical objects or thoughts. An example of a conceptual system is a computer program that has symbols that represent units and mathematical operators that represent the relationships between the units (Duncan, 1972). Additional examples include object-oriented programming (OOP) and entity-relationship models. According to Daniel M. Duncan in his article, *James G. Miller's Living Systems Theory: Issues for Management Thought and Practices*, Living Systems Theory is a conceptual system whose units are "commonly related by verbs" whereas concrete systems contain units that are "measured in space/time dimensions" (Duncan, 1972). All concrete systems operate or exist in a physical space. Abstract systems are "composed of units and relationships chosen by an investigator to suit his convenience" (Duncan, 1972). Some units in an abstract system can be measured in space/time while others cannot because they are abstractions "created to serve the investigators goal" (Duncan, 1972).

In his book, Miller asserts that one must be clear about whether he or she is describing a conceptual, concrete or abstract system and refrain from mixing the three. Miller writes:

> Scientists who make observations and measurements in any space other than physical space should attempt to indicate precisely what the transformations are from their space to physical space (Miller, 1995).

Because concrete systems have a category called "living systems", Miller's Living Systems Theory approach is applicable to describing insurgency movements.

F.   PROPERTIES OF LIVING SYSTEMS

To be considered a living system, Miller identifies seven specific criteria which a concrete system must possess: 1) organizationally open, but energetically closed; 2) maintains equilibrium; 3) combats entropy; 4) possesses a template; 5); possesses subsystems; 6) contains a decider; and 7) possesses integrated subsystems.

1.   Organizationally Open, but Energetically Closed

Living systems can be described as both open and closed systems. As an open system, they allow matter, energy and information to flow through their permeable boundaries to be processed as inputs from their environment. Inputs can be viewed as the raw materials for the system's metabolism while the outputs can be viewed as the products and wastes of internal processes (Duncan, 1972). The inputs are essential for the system's survival. As closed systems, they refrain from accepting anything alien that could possibly infect the system. If a living system is too closed off to inputs from the environment it will dissolve into chaos and disorder and will eventually die.

2.   Maintains Equilibrium

Living systems must be able to repair internal breakdown. Thus, they have to constantly maintain certain levels of energy and order within their internal environment regardless of fluctuations in their external environment. Moreover, living systems have a narrow range of stability. If the system is under much stress, then it will lose stability. If the system cannot revert itself to stable conditions, then it will not survive. Examples of

this include humans' need to maintain a blood pH of 7.0 and a core body temperature of 98.5°F in order to survive despite the fluctuations of temperature in their external environment.

3.   Combats Entropy

Living systems have a level of organization sufficient to maintain internal processes. Thus, the system has to convert energy and resist entropy. The amount of inputs that flow through a living system's boundaries determines the level of entropy within the system. Entropy within a system can decrease, remain the same, or increase. However, living systems are considered *negentropic*. In other words, they tend to "resist the entropy breakdown predicted by the second law of thermodynamics" (Duncan, 1972).

4.   Possesses a Template

Not only do living systems combat entropy, they possess a template. According to Miller, a *template* is "a specialized form of information processing" or blueprint (Miller, 1995). Every living system possesses a template that is already programmed with information on the system's structure and process from the moment of origin. For example, a living system has a template that defines its purpose and outlines its organizational structure. In biological systems, the system's template is DNA while in social systems the charters, constitutions and similar documents are considered to be the system's template.

5.   Possesses Subsystems

Within each living system, there are subsystems. All subsystems must work together to achieve the goals and objectives of the system. Miller argues that in order for a living system to survive, twenty critical subsystems processes must be carried out. These twenty critical subsystems, listed in Table 1, can process information, matter-energy, or both.

SUBSYSTEMS WHICH PROCESS INFORMATION AND MATTER-ENERGY	
Boundary	
Reproducer	
SUBSYSTEMS WHICH PROCESS INFORMATION	**SUBSYSTEMS WHICH PROCESS MATTER-ENERGY**
Input Transducer	Ingestor
Internal Transducer	--
Channel and Net	Distributor
Decoder	Convertor
Associator	Producer
Memory	Matter-Energy Storage
Decider	--
Encoder	--
Output Transducer	Extruder
--	Motor
--	Supporter
Timer	--

Those with a dash mean there is not an equivalent subsystem that serves the same function.

Table 1.   The Twenty Critical Subsystems of Living Systems Theory (Miller, 1995).

A system that is independent of other systems must be capable of performing each of the critical subsystem processes.   However, many complex societies depend on other societies to carry out specific subsystem processes.   In addition, subsystems can be further categorized as inputs, throughputs and outputs, as shown in Table 2. The twenty subsystems will be discussed at length in Chapter V.

Process Location	Process Type	Subsystem	Description of Process
Systems Input Stage	Information	Input Transducer	*Brings information into the system*
	Matter-Energy	Ingestor	*Brings material-energy into the system*
Systems Throughput Stage	Information	Internal Transducer	*Receives and converts information brought into system*
		Channel and Net	*Distributes information throughout the system*
		Decoder	*Prepares information for use by the system*
		Associator	*Maintains appropriate relationships between information sources*
		Memory	*Stores information for system use*
		Decider	*Makes decisions for the entire system based on previous information*
		Encoder	*Alters the code of information from private to public code*
		Timer	*Maintains the appropriate spatial/temporal relationships*
	Matter-Energy and Information	Reproducer	*With information, carries on reproductive function*
		Boundary	*With information, protects system from outside influences*
	Matter-Energy	Distributor	*Distributes matter-energy for use throughout the system*
		Converter	*Converts matter-energy into suitable form for use by the system*
		Producer	*Synthesizes matter-energy for use within the system*
		Matter-Energy Storage	*Stores matter-energy for use throughout the system*
		Motor	*Handles mobility of various parts of the system*
		Supporter	*Provides physical support to the system*
Systems Output Stage	Information	Output Transducer	*Handles information output of the system*
	Matter-Energy	Extruder	*Handles matter-energy discharged by the system*

Table 2.   Twenty Critical Subsystems of Living Systems arranged by Input-Throughout-Output.

6.   Contains a Decider

All living systems contain a decision-making unit that controls the entire system. The decider surveys the internal state of the system and the relationship between the system and its environment based on information passed by the subsystems. Based on the survey and information relayed from the subsystems, the decider makes the necessary adjustments to the systems' subsystems and components in order to maintain internal equilibrium. If a living system is totally dependent on another system to make decisions then it cannot be considered a living system, but only a part or component of the other system.

7.   Possesses Integrated Subsystems

Living systems must contain subsystems that are integrated and self-regulating. Also, they must have the capability of development and reproduction. A subsystem cannot work alone. It must work with other subsystems to act as a whole with a purpose and goal.

G. CHARACTERISTICS OF THE EIGHT LEVELS OF LIVING SYSTEMS

As mentioned earlier in the Chapter, Miller identifies eight distinct levels of living systems. These are: 1) the cell; 2) the organ; 3) the organism; 4) the group; 5) the organization; 6) the community; 7) the society; and 8) the supranational system. Miller suggests that the eight levels of living systems share the following five major elements:

1. Structure

Miller defines the term *structure* as the "arrangement of the systems' subsystems and components in three-dimensional space at a given moment in time" (Miller, 1995). A structure can change or remain fixed over time depending on the processes in the system. A system's structure can also be stable only if the system is stable. Miller stresses that the concept of "stability" not be confused with the concept of "structure". The structure of insurgencies is easier to observe when they are stable, but the spatial organization of insurgencies is its structure whether it changes slowly or rapidly. A representation of the structure of an insurgency is the organizational chart.

2. Processes

In addition to structure, each level performs processes. Out of all of these elements, one has to take extreme caution in understanding the difference between structure and process. Miller defines the term *process* as the "change over time of matter-energy or information in a system" (Miller, 1995). A process can be in the form of an activity or action. Examples of processes include insurgents moving resources between cities or facilities in which they inhabit, insurgents sending letters to other insurgents as means of communication, and insurgents making decisions, creating products and constructing infrastructures. These processes are essential in defining the reason for the establishment of the insurgent system and converting the organization's inputs into outputs to be consumed by the environment or other organizations as inputs.

In addition, a process includes two elements: function and history. A function is an ongoing, reversible action while history is irreversible action, such as a mutation, aging and death. According to Miller, a living system carries its "history with it in the form of altered structure, and consequently of altered function also" (Miller, 1995). An

example of a process that has a function element is drawing blueprints of the insurgency's organizational structure. An example of a process that has a history element, on the other hand, is an insurgent detonating himself in a suicide mission.

3. Subsystems

Each level consists of subsystems that provide a key characteristic of the overall system. They exist in one or more identifiable structural units of the system. Each level is composed of twenty critical subsystems that process inputs, throughputs, and outputs of various forms of matter-energy and information. Subsystems should not be confused with components. Unlike subsystems, components have a decider and can carry out one or more processes. The concept of component processes is equivalent to the concept of role (Miller, 1995). For example, insurgencies have clearly defined roles (or component processes) and insurgents fill those roles. In general, the more complex a system becomes the more components it will contain. An example of components in an insurgency is the insurgents.

4. Relationships

Not only do all the levels have structural characteristics they also have two types of interactions: 1) internal relationships among subsystems or components; and 2) system-wide processes. The first type of interaction explains the relationship between the structure and function of these two single units of systems while the later concerns multiple-subsystem units or total system. The second type of interaction gives the analysts a wider perspective in how the inputs and outputs of the entire system work together.

There are three types of internal relationships among subsystems or components: 1) structural; 2) process; and 3) relationships that involve meaning. First, structural relationships explain the arrangement among "subsystems or components of concrete systems are all spatial in character" (Miller, 1995). An example of a structural relationship in an insurgency is the size of an insurgent group. Second, process relationships can be categorized as being purely temporal or spatiotemporal in nature. Temporal relationships focus on time while spatiotemporal relationships are focused on

the actions performed among the subsystems. An example of a process relationship is the number of times and insurgent group interacts with another insurgent group over a period of time. Or, the number of suicide missions launched each day. Lastly, the third relationship requires the term "meaning" to be defined as "the significance of information to a system which it processes it" (Miller, 1995). These relationships will have different interpretations. An example of this relationship is when an insurgent interprets his leader's orders.

5. System Processes

There are six types of system processes: 1) process relationships between inputs and outputs; 2) adjustment processes among subsystems or components, used in maintain variable in steady states; 3) evolution; 4) growth, cohesiveness, and integration; 5) pathology; and 6) decay and termination.

The first process analyzes the relationship between inputs and outputs. All inputs are followed by a specific output. This is true among subsystems that process matter-energy and information. An example of this would be to measure the amount of arms and weaponry an insurgent group had taken from the storage units from the previous regimes and the amount it had used up to determine if it had enough to continue fighting.

The second process is concerned maintaining equilibrium within the system by adjusting process among its subsystems or components. As mentioned before, all living systems must remain stable. If there is a change in any variable, which can be matter-energy input, internal, and output variables and information input, internal, and output, maintained in steady state in a living system, the system may evoke adjustment processes. According to Miller, living systems employ adjustment processes for three reasons: 1) to govern relationships among its subsystems; 2) govern the system as a whole; and 3) govern relationships between the system and its suprasystem (Miller, 1995). The three adjustment processes keep variables stable and within their range tolerance. There are several ways in which systems can employ this adjustment process. An example of a matter-energy input adjustment would be the requirement to increase the rate of ammunition supply to an insurgent group or cell.

The third process is evolution. Living systems constantly change over time. They produce systems with more information or greater complexity of organization. Living systems that evolve into more complex systems generally have more adjustment process. Thus, these systems are better able to adapt to changes and overcome the stresses exhibited by their environment. The reverse is true for less complex systems. In fact, it can be assumed that evolving living systems are learning systems. They rely on the feedback from their actions to determine their next course of action or structure of the organizations. As mentioned in the previous chapter, insurgencies are constantly evolving; they do this over time, ranging from seconds to years. Their emergent processes and structures are more suitable to withstand the environmental pressures; however, the new changes are irreversible.

The fourth process deals with growth, cohesion and integration. Miller defines growth as a "progressive, developmental matter-energy process which occurs at all levels of systems" (Miller, 1995). Systems that grow in size, number and complexity often mean they are constantly reorganizing their relationships among their subsystems or components. One of the features of reorganization in living systems is the emergence of new levels within the system. For example, insurgencies always give rise to new insurgent groups. The new group that develops on top of the old insurgent system must remain viable during the transition period. Miller defines cohesiveness as the "tendency of systems to maintain sufficient closeness in space-time among subsystems and components—or between them and the channels in physical space which convey information among them—to enable them to interact, resisting forces that would disrupt such relationships" (Miller, 1995). Insurgent groups move more freely in space, so they communicate over channels which vary in length. However, they keep close enough together to ensure the effective operation of the channels in physical space among them. Integration involves bringing separate processes of a system work under one centralized control. Examples of such integration are insurgent groups launching joint missions.

The fifth process deals with systems that enter a pathological state. In other words, there is an increase in cost of adjustment processes to keep the system's variables within its range of stability. Some pathological states can be corrected with little damage

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to the system while others bring about a "new, and often but not always, a less desirable, steady state" (Miller, 1995). The new system produces a new structure; this process is irreversible. Miller identifies eight different types of pathology: 1) lack of matter-energy inputs; 2) excess of matter-energy inputs; 3) inputs of inappropriate forms of matter-energy; 4) lack of information inputs; 5) excess of information inputs; 6) inputs of maladaptive genetic information in the template; 7) abnormalities in internal matter-energy processes; and 8) abnormalities in internal information processes (Miller, 1995). If an insurgency lacks information inputs, for example, it will not survive. Insurgencies, like the one in Iraq, have an overwhelming information advantage. It cannot afford to allow insufficient or faulty information to be sent across its boundaries.

The sixth process explains systems decaying and terminating over time. According to Miller, a living system eventually dies when it does one or more of the following things: exhaust all its adjustment processes and is unable to maintain one or more of its critical variables within its stability range, lose control of its information transmissions and feedback loops, and fails to keep its subsystems and components adjusted to one another and the total system in steady state with its environment (Miller, 1995). Insurgencies can decay and terminate over time. If they are terminated, it is usually due to dysfunctions that cannot be corrected.

H.   SUMMARY

James Grier Miller's *Living Systems* (1978, 1995) outlines a general theory that focuses on concrete systems from the cell through the supranational levels. Miller develops a complete analytical, conceptual framework that describes the nature, structure, processes and behavior of all living systems using bits of knowledge from various disciplines. He takes great care in observing all levels of living systems and demonstrating how his framework is applicable across several levels of living systems and is useful in identifying and supporting cross-level hypotheses which describe system behavior. Thus, his theory attempts to avoid biases and takes a non-reductionist perspective.

In addition, Miller's theory unravels the complexity associated with living systems with the intent of making it easy for anyone to apply his theory's concepts to everyday life. For example, Reindenbach and Oliva were able to apply Miller's theory to marketing. Miller's theory helped the authors identify a set of marketing processes and relate those processes with other academic disciplines. Similarly, they were able to compare marketing processes with management and accounting processes.

For these reasons, a living systems approach is very fitting to describe and understand insurgencies. Insurgencies are complex, interrelated systems that can only be studied within a systemic context. Therefore, the current approaches being used to rethink insurgencies, as highlighted in Chapter II, fall short when dealing with complex systems. A living systems approach portrays the processes that occur within a living system which are necessary in understanding insurgencies. The next chapter applies Miller's living systems framework to describing the structure and processes of the Iraq Sunni Insurgency.

IV. STRUCTURE OF IRAQ SUNNI INSURGENCY

A. OVERVIEW

This chapter demonstrates the use of living systems as a framework to describe the current Iraq Sunni Insurgency, specifically analyzing its IED Unit and one IED Cell. A similar analysis can be applied to the insurgency in Afghanistan and to the other insurgencies in Iraq and elsewhere around the globe.

This chapter is divided into three sections. The first section highlights important definitions from General Systems Theory to study insurgent systems. The second section discusses the organization of the Iraq Sunni Insurgency. The third section puts it in context with Miller's concept of levels and explains the importance of keeping analysis within a level and redraws the insurgency hierarchical structure with living systems terminology. These three sections are essential to establishing the basis of the unified general framework of insurgency.

B. GENERAL SYSTEMS THEORY AND ANALYSIS

Living Systems Theory is based on Miller's belief that:

> All nature is a continuum. The endless complexity of life is organized into patterns which repeat themselves—theme and variations—at each level of system (Miller, 1995).

Living Systems Theory is thus an example of Bertalanffy's General Systems Theory applied to living things (Bertalanffy, 1968). The next chapter discusses in the context of an IED Cell the twenty critical subsystems that exist at each tier of the living system. It is important to note that these subsystems are not identical at each level, for example, the subsystems of a single IED Cell are not the same as those in an insurgency. However, Miller builds a system theory that identifies by function the subsystems that must appear at each level. This provides a framework at each level for classifying the processes in any living system, in our case, an insurgency system and its subsystems.

A system is composed of subsystems. If the analysis of a system is reduced to only the analysis of its subsystems, this is called reductionism. A reductionist approach is successful only if the system is equal to the sum of its parts. Reductionism does not succeed for living systems; for example, understanding how cells and organs function does not explain how organisms work.   That is, at each level in addition to its components there are other processes at work. For example, if you know everything about an IED Cell, you still do not understand how an insurgency will work to replace and reassign insurgents after a cell is damaged.

When mounting a counterinsurgency campaign against IED attacks it is important to understand that damaging or even destroying an IED Cell has only limited impact because the insurgency can quickly reconstitute the cell or assign survivors to another cell. Thus, to counter an insurgency it is necessary to take a systems view of the whole of the insurgency and any analysis must use non-reductionist approaches.

C.   ORGANIZATION OF IRAQ SUNNI INSURGENCY

The overall Sunni Insurgency is organized into a number of subsidiary units, which include, kidnapping, crime, politics, IEDs, assassinations, and many other units. Each unit is composed of a number of cells, which generally have 3-10 people. Figure 3 shows the partial hierarchical structure of the insurgency.
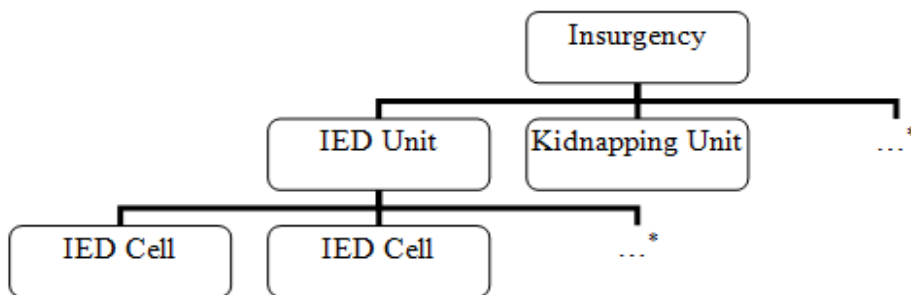
* "..." Marks symbolize other additional units or cells.

Figure 3.   Partial Hierarchical Structure of the Iraq Sunni Insurgency.

In the figure above, the insurgency has a hierarchical structure consisting of three distinct tiers that is very flat. This structure has evolved over time with the growth of various units, each with its own leader and specialization.

For example, one unit might be dedicated to "controlling the information flow, synthesizing data produced by their militia brothers," another unit to "acting as official spokesmen," and another unit to "military specialization" (International Crisis Group, *In Their Own Words: Reading the Iraqi Insurgency*, 2006). Over time, visible leaders emerge within the specialized units to become the "larger entities that know and communicate with each other" (International Crisis Group, *In Their Own Words: Reading the Iraqi Insurgency*, 2006). However, as seen in many insurgencies, differences arise between the major leaders within the insurgency. For example, one leader might focus on suicide operations while another leader might focus on targeting members of their country's security forces. It is not uncommon to see differing insurgent units engage in heated discussions and armed confrontations. Many units, even though they work for the insurgency, are still committed to actively pursuing their unit's former political and military objectives even if there are not in line with the insurgency's objectives.

Even though the units within the insurgency may have their own agendas, the units have been able to consolidate their power because of direct guidance from their insurgency leader and from their own understanding of the organization's overall mission objectives. The insurgency uses extreme decentralization practices in its decision making and operations. Decentralization is preferred over a traditional "chain-of-command" because the former gives the insurgency a higher capacity not only to respond more effectively in rapidly changing information saturated environments but be more resistant and invulnerable to counterinsurgent attacks due to its flexibility and adaptability (Metz, 2007b). Decentralization also serves as a mode of survival for the insurgency, allowing resources, information, and decision making authority to be easily diffused.   The disadvantage of the insurgency being highly decentralized in decision making and operations is that it cannot undertake large-scale conventional military operations. Instead, it can only resort to terrorism and hit-and-run guerrilla tactics as a means to intimidate their opponents and influence "both a proximate audience and a distant one"

(Metz, 2007b). Because the Iraq Sunni Insurgency operates in a decentralized manner, no single element within the insurgency is vital to its survival.

Military intelligence identifies the Iraq Sunni Insurgency to be primarily organized in highly compartmentalized local and regional units and cells. If a cell or unit is attacked, the killed or captured insurgents are quickly replaced with new recruits. If an insurgent survives the attack, he or she can be "recruited into existing cells or establish new cells" (White, 2006). Hence, the structure of the Iraq Sunni Insurgency proves to be well adapted to replacing losses and reconstructing the cells and leadership.

D.   LIVING SYSTEMS INSURGENCY FRAMEWORK

Now that we have established the current view of the organizational structure of the insurgency, we can revise the structure using Miller's concept of levels. In Chapter III, Miller explains there are eight levels of living systems. The Iraq Sunni Insurgency does not have eight levels, only two distinct levels—organization and group. According to Miller, an organization is a system that has "at least two echelons in [its] decider". The term *echelon* is equivalent to the military sense of a step in the "chain of command". In all organizations, the echelons are hierarchically arranged in the decider subsystem. In a decentralized organization, like the Iraq Sunni Insurgency, "certain types of decisions are made at lower echelons and not transmitted to higher echelons in any form" (Miller, 1995).

In the Iraq Sunni Insurgency, the insurgency and insurgent units both are equivalent to the organization level in a living system because each level has multiple echelons within its decider subsystem. As mentioned earlier, the insurgency is composed of various insurgent units and components including insurgent leaders from each unit to make decisions for the entire insurgency. Within the insurgency, an insurgent may be assigned to be the head leader of all the insurgent leaders. In this case, there are two echelons within this level: 1) the insurgency leader; and 2) the unit leaders. This observation can be made for the insurgent unit, which is composed of several insurgent cells and also has two echelons: 1) the unit leader; and 2) the cell leaders.

A group, on the other hand, is defined as:

> …a set of single organisms, commonly called members, which over a period of time or multiple interrupted periods, relate to one another face-to-face, processing matter-energy and information (Miller, 1995).

A group is different from an organization, the next higher level of living systems, in three ways:

> … (a) the members, though ordinarily mobile, are usually near enough together to see and hear one another; (b) each one potentially can communicate directly with every other one over two-way channels, although some of these may not be open at times; (c) there are no echelons, since by definition an organization is a system with echelons composed chiefly of groups (and perhaps come single individual organisms) (Miller, 1995).

It is important to note that the major difference between a group and an organization is that an organization has multiple echelons while a group has none. An insurgent cell is a group because it has no echelons in its decider since it is the lowest level in the insurgency chain. The members within the cell interact with each other face-to-face. Their only primary function is to carry out the assigned tasks designated by the cell leader. By applying these two levels to the Iraqi Sunni Insurgency, the new revised structure is illustrated in Figure 4.
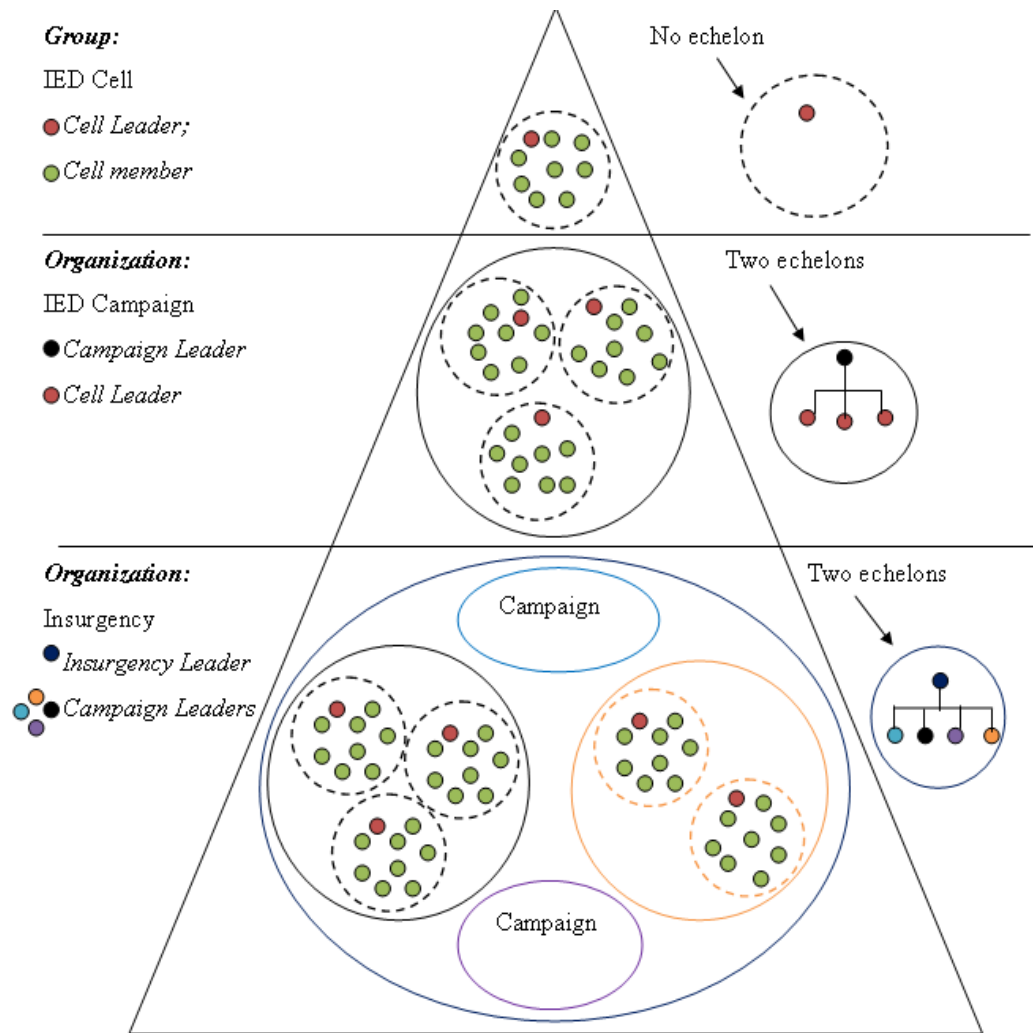
Figure 4.   Revised Structure of the Iraq Sunni Insurgency.

According to Miller, it is imperative that every discussion "begin with an identification of the level of reference" (Miller, 1995). Once the level in a system is identified, the discussion should not change to another level unless the next level is another system. It is fundamental, as Miller argues, that a person applying his theory to a living system understand that "systems at the indicated level are called systems". This idea should not be confused with the level above a system, which is called the suprasystem, the next higher level, the suprasuprasystem, the level below, the subsystems, and below them, the subsubsystems. For example, if studying a specific

insurgent unit within the Iraq Sunni Insurgency, the insurgent cells in that unit are the subsystems while the insurgency is the suprasystem, as seen in Figure 5.
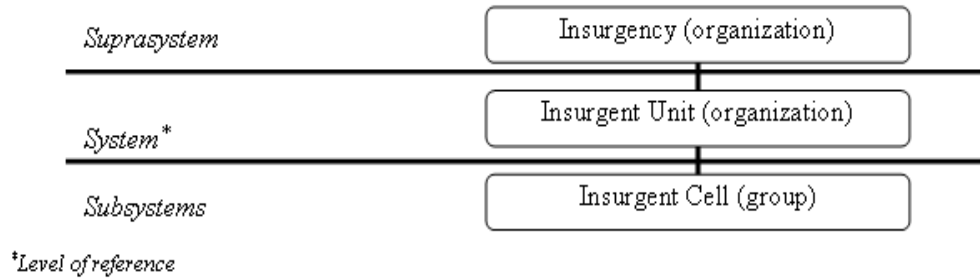
Figure 5. Revised Structure of the Iraq Sunni Insurgency with Levels.

E. SUMMARY

This chapter has identified and distinguished the levels within the Iraqi Sunni Insurgency. Miller's Living Systems Theory provides a vocabulary and structure that can be applied to any part of the Iraq Sunni Insurgency. The next chapter goes into detail to explain the functions of the IED Cell by walking through the twenty critical subsystems that process matter-energy and information.

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V.   THE IED CELL

A.   OVERVIEW

This chapter uses the unifying general framework for insurgency adapted from Miller's Living Systems Theory to describe an IED Bomb Making Cell within the Iraq Sunni Insurgency. This will be accomplished by showing how the structure and the processes of the framework are expressed in the IED Cell. Note that this is not the same as describing the IED Cell using the Living Systems Theory vocabulary. This thesis does not want to project the details of a particular contemporary insurgency into the framework; instead it wants to use the framework to guide readers to identify and name those features of the IED Cell that are present in all insurgencies.

This approach supports better historical analogies. For example, by describing the function of information in general terms this thesis compares the function of the Internet, telephones, books, etc., to the same function in historical insurgencies that did not have these technologies. A general framework allows readers to correctly identify the matter-energy processes in insurgencies that preceded the modern use of IEDs and even before the existence of explosives.

The goal is to identify in contemporary insurgencies, the structure, processes, and critical subsystems that transcend time, location, and culture, just to name a few. The framework spans multiple disciplines by incorporating modern technology with ancient concepts such as kinship and loyalty. Thus, this chapter presents the components of the framework and then identifies features of the IED Cell that implements them.

B.   DESCRIPTION OF AN IED CELL

An IED Cell is the lowest level in an IED Unit. These cells are responsible for developing IEDs to inflict damage on counterinsurgents and infrastructures. An IED Unit is comprised of several IED Cells, each strategically located within the insurgency's operational area. As seen in Figure 6, some of the IED Cells interact with other IED Cells while others do not. The reasons for these occurrences are some cells are in close

proximity to one another, allowing for easy access to other cells, while other cells prefer to remain interdependent from their counterparts, making it harder for counterinsurgents to track their networks.
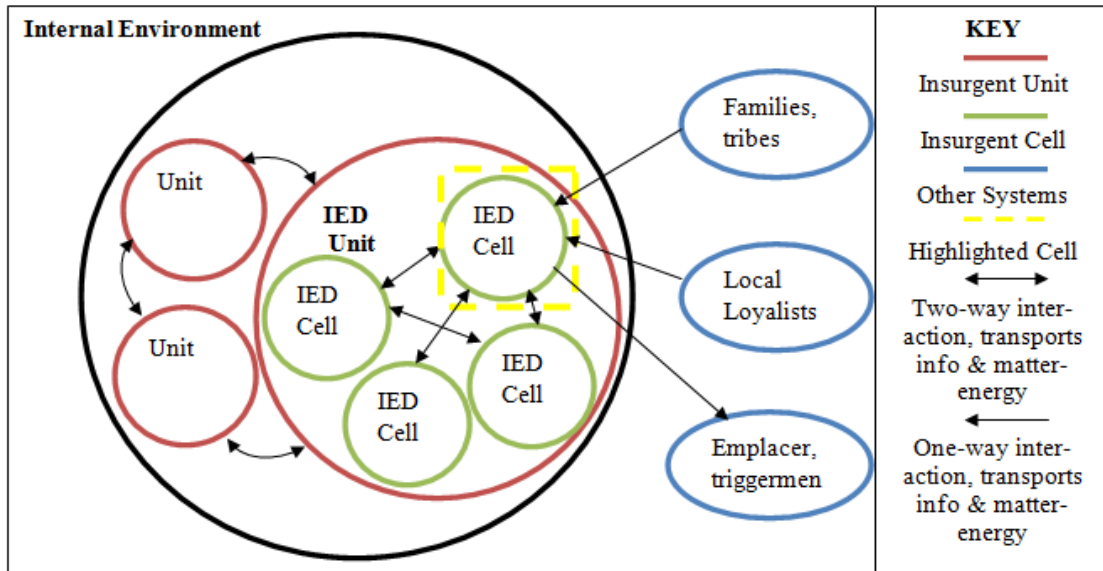
Figure 6.   IED Cell Interactions.

In an IED Unit, no single IED Cell is vital to the insurgent system. If a cell is eliminated it has little impact on the functioning of cells like it and cells in other Units. Depending on the technological advancement of the IED Unit, an IED Cell can be replaced immediately or its salvaged components can be distributed to other IED Cells.

C.   STRUCTURE

When analyzing the structure of a group, like an IED Cell, Miller recommends first analyzing its size. Miller defines the term *size* as number of members in the group. An IED Cell may have 3-10 members that are responsible for carrying out processes within the cell. The members are brought together through their family or tribes. They all have close-knit relationships and are highly connected to their community. Because of their community ties, the IED Cells only form relationships or interact with people within their internal environment. Their networks range from family and tribal members

to local sympathizers and loyalists. Very rarely will IED Cells have external networks; they are very isolated and specialized within the IED Unit.

Depending on the number of members within the cell, each member may be assigned a specific function. For example, one member may be assigned to be the decider or the decider may be dispersed among all members so that they are all part of that subsystem. The assignment of jobs may be based on the member's age, sex and experience with making IEDs or history in the insurgency. Many IED Cells only have two positions which a member can hold —an IED maker or IED technician.

In addition, the structure of the dwelling in which the IED Cell operates determines its processes. If an IED Cell is located underground then it requires more restricted behavior than the behavior of IED Cell that is located in a building in major city. The underground cell does not have immediate access with its environment like the cell in the city.

D.   PROCESSES

Groups are frequently classified according to the processes they carry out. An IED Cell is classified as a "work group" that is primarily concerned with creating a product to be used by both its internal and external environment. Because an IED Cell is not completely isolated from its environment, it still receives assistance from other systems in its internal environment to carry out some of the critical subsystems, which are discussed in the next section. The major processes the cell must perform in order to function adequately are importing matter-energy, assembling matter-energy, exporting products and waste, and storing matter-energy and information. These four processes are critical to the cell and can be shared among other subsystems.

E.   SUBSYSTEMS

Miller divides his subsystems based on those that can process information, process matter-energy, or both. This section discusses the twenty critical subsystems of Living System Theory in the context of the IED Cell.   In every IED Cell, the division of labor allocates the different subsystem processes to various individuals within the cell. The subsystems within the cell are described below. Figure 7 pictures an IED Cell, showing its subsystems.

INPUTS

THROUGHPUTS

OUTPUTS

Retrieve previously stored information

Decode info

Decide cell's next movement

−number of IEDs made, their location, other information

Information

-Local informants

-Members from IED campaign group

Transmit info via networks, verbal/written communication

Encode new info

Receive info

Convert matter-energy into info

Compare new info with stored info

Send new info

Times actions/events in the cell

Local supporters and cities

Reproduce matter-energy

Produce IEDs

Excrete waste and products

Matter-Energy

-Supplies from supplying subsystem

-Money from financing subsystem

-Manpower from recruiting subsystem

Receive inputs

Break down materials into smaller parts

−IEDs

A physical space, such as a safe or storage unit

An individual, group of individuals, or transportation device responsible for distributing materials, products, or waste

KEY

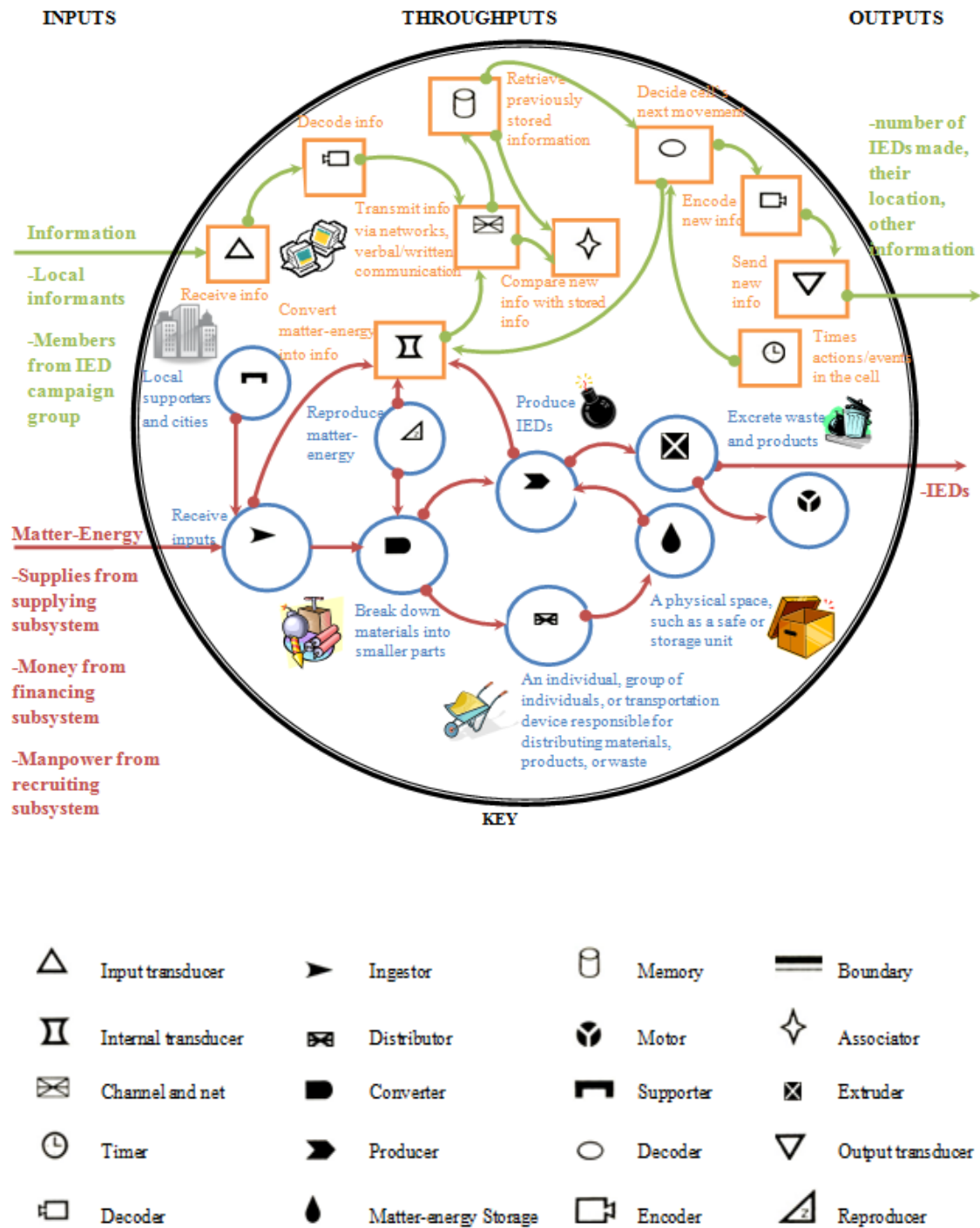| Symbol	Name	Symbol	Name	Symbol	Name	Symbol	Name
△	Input transducer	➤	Ingestor	⌷	Memory	▬	Boundary
Ⅱ	Internal transducer	⋈	Distributor	⊙	Motor	◇	Associator
⋈	Channel and net	◼	Converter	⌐	Supporter	⊠	Extruder
◷	Timer	➤	Producer	○	Decoder	▽	Output transducer
⊡	Decoder	⬤	Matter-energy Storage	◻	Encoder	◿	Reproducer

Figure 7.   Twenty Critical Subsystems in an IED Cell.

1.   Subsystems Processing Matter-Energy and Information

The first category consists of two subsystems which process both matter-energy and information. Both of these subsystems are essential to the survival of all living systems.

a.   Reproducer (Reproducing Process)

Living systems are able to replicate themselves. To accomplish this task, the reproducer transmits the information needed to organize, and the matter-energy necessary for construction of the offspring system. There are many processes that are conducted by this subsystem in order to replicate another IED Cell that can fully operate in its new environment. This discussion highlights two main processes that give rise to IED Cells that are fully functional in an IED Unit.

The first stage in developing an IED Cell is programming it to perform the following three tasks: 1) store memory; 2) perform functions; and 3) receive and send messages and information. An IED Cell, by itself, is not useful. It must communicate with other cells by calling on each other's functions and reading from each other's memories. These simultaneous interactions between cells exhibit complex patterns of self-generated behaviors and organizations not explicitly designed into it.   This phenomenon, also known as emergence, can arise spontaneously. Thus, each IED Cell has a specific complex function that is distinguishable from other IED Cells in the same insurgency. The newly created IED Cell can interact with other IED Cells, creating highly complex insurgencies or insurgent structures.

The developmental process of an IED Cell can be reproduced over many generations. However, for every generation there can be different versions of the cell. The difference in system functions among generations is due to combing the information passed from previous generations with current updated information. As a result, a series of new IED Cells are continuously created to adapt to the ever changing state of their environment. This is the essence of a reproducer in a living system, which is "capable of giving rise to other systems similar to the one it is in" (Miller, 1995).

Over time, complex IED Cells become self-sustaining. In other words, when the cell undergoes changes it does not have to reprogram itself to update the changes. Instead, the cell constantly relies on feedback from its inputs and outputs and its internal and external environment. This feature makes it very easy for the cell to update for error or accuracy without having to resort to changing any part of the cell itself. The only part of the cell that can be changed is the overarching IED Unit itself, which is broken up into small, independent IED Cells that can be worked on independently. The overarching Unit is responsible for continually recreating IED Cells in the system and completely rebuilding the whole structure from scratch to include any new information and modifications.

Overall, the reproducer subsystem in an IED Cell is responsible for giving rise to new cells of that type that will carry out the processes of the twenty critical subsystems. Over time, the reproducer acquires matter-energy and information needed to produce offspring. This subsystem acquires these materials through the cell's internal environment and the storage units within the cell, which will be discussed in the following subsection. As the cell matures and grows, so does its reproducer. The reproducer determines the technological advancement of the cell. For example, if an IED Cell has many internal connections and uses the technology of its time to process matter-energy and information, then its reproducer should be very advanced and quick to respond to the changes within its environment. This leads to an insight that is true for all insurgency—the more complex the operations they perform the larger and more advanced is its reproduction function. That implies that cells with simple operations can move easily and quickly reproduce themselves and thus grow the insurgency more quickly.

b.   Boundary (Shielding Process)

A boundary is a line or point where a system or subsystem can be differentiated from its environment or from other subsystems. In particular, a boundary:

> …holds together the components which make up the system, protects them from environmental stresses, and excludes or permits entry to various sorts of matter-energy and information (Miller, 1995).

An IED Cell may have matter-energy boundaries, such as designated cell members guarding sanctuaries to prevent counterinsurgents and their equipment from entering, or information boundaries, such as cell members screening classified information as it enters or leaves the group or cell. Regardless of the type of boundary, the IED Cell must strictly monitor all information and matter-energy that crosses its boundary.

As mentioned earlier in the thesis, the boundaries at each level within the insurgent system are different from one another. An IED Cell's boundary is different from the IED Unit and insurgency boundary. An IED Cell only allows certain types of bombs, equipment, funding and information to be transported across its boundary because its function is very specific. Since the IED Cell is the lowest level and most important subsystem within the insurgent system, it cannot afford to accept information or matter-energy that is corrupt and, in turn, affect its internal processes. Thus, the cell's boundary must be able to screen and eliminate these defective materials and information.

An IED Cell's boundary defines the limit between the insurgent movement and its environment. The matter-energy that arrives at the boundary of the cell comes in the form of raw materials that will be used by it. Along with being a barrier, the cell's boundary filters the matter-energy in order to keep the external and internal system in equilibrium. Thus, a cell's boundary can be permeable, impermeable, or both.

A permeable boundary allows information and matter-energy to flow freely, resulting in an open system. IED Cells accept resources that only help accomplish their goals and objectives. Thus, these types of cells are very selective in choosing the type of resources and materials that is sent to the organization. An impermeable boundary, on the other hand, strictly controls (or even restricts) the acceptance or dispensing of information and matter-energy, resulting in a closed system. IED Cells can also be very selective as to who can hold a position within the organization. Having this selectivity can eliminate the possibility of accepting individuals who are informants and supporters of the current regime who disguise themselves so they can destroy the cell from the inside out. Attacking the cell's boundary will prohibit energy from entering into the system and, thus, cause it to collapse. IED Cells usually have both types of

boundaries within its system in order to retain a steady state. For a specific insurgency, determining how the boundary is constructed can give insight about what can be introduced that will destabilize the group, such as defective parts and disinformation. Once the information and matter-energy successfully penetrate the cell's boundary, they are each processed through a series of subsystems that are specific to one or the other.

2. Subsystems Processing Matter-Energy

Eight of the twenty critical subsystems are involved in the processing of matter-energy, attesting to the paramount importance of matter and energy to any living system. One of the major functions of the Iraqi Insurgency is to convert the matter from the environment to energy that it can use to perform work in its physical space. The following subsystems—ingestor, distributor, converter, producer, matter-energy storage, extruder, motor, and supporter—convert matter into energy that can be used by the system.

a. Ingestor (Receiving Process)

This subsystem brings the matter-energy across the system's boundary. The matter-energy can be nonliving, such as supplies, equipment and tools, and living, such as humans or animals. They are all received from the environment to be transformed into inputs that are useable by the system. Every level within a living system may have a specialized ingestor that is programmed to import only certain types of matter-energy. The ingestor process may be downwardly dispersed to an individual organism or laterally dispersed to all individuals within the system. The process may also vary based on the cost of expenditure of energy to obtain matter-energy.

The ingestor subsystem in an IED Cell imports many forms of matter-energy into the cell for processing. Matter-energy, in this case, can be physical materials, such as bomb, wires, equipment and money, or it can be materials that bear markers, such as color and weight. This subsystem may be limited to a single insurgent or laterally dispersed to all insurgents within the cell. Cell members who gather supplies or are in charge of supplies or combination of these are components of the ingestor in one cell or another. Cell members who bring new members to the cell are also part of the ingestor.

Some IED Cells spend money on resources instead of their own energy for much of the ingesting process. For example, a cell member may purchase equipment and raw material via the Internet or from a local store. Other IED Cells may gather materials for their processes. In this case, a designated cell member may have to search for scrap metal, wires and bombs in his local environment. An IED Cell may spend most of its energy and time into conducting this process.

b.   *Distributor (Distributing Process)*

Once the matter-energy enters the system by the ingestor, the distributor subsystem must transport it to the appropriate components within the system. Like the ingestor subsystem, the distributor subsystem may be carried out by a single individual or laterally distributed to all members in the system. In some systems at the group level, matter-energy is distributed in an orderly fashion to each separate member in turn, like an assembly line. Once the system consumes all the imported matter-energy, it uses the distributor subsystem to send its products and wastes into the environment to be used by other systems. If a system has an inefficient distributor or cannot maintain adequate distribution to all essential components, then the system will lose energy.

In an IED Cell, a cell member who distributes the supplies, food and other matter-energy to other cell members is an example human component of the distributor. The distributors can also be artifacts such as roads, trucks, the Internet or the social networks that supply the IED Cell with money, equipment, and manpower or transport matter-energy to and from the cell. Since the IED Cells produce IEDs, it is not unlikely that they operate like an assembly line. If they do operate like assembly lines then all cell members are distributor components. Thus, the rate of matter-energy flow through the distributor becomes important to the cell where output may be limited by inefficient distribution of materials. A fault distributor, in this case, can greatly affect the cell's functioning capabilities, such as ensuring imported materials are sent to the bomb assembly line or to the cell's storage unit and ensuring waste and products are sent to the extruder subsystem, which will be discussed later. It can also contribute to the cell's energy loss. Hence, the IED Cell must ensure its distributor subsystem is efficient enough to achieve its and the insurgency's objectives.

c.   *Converter (Transforming Process)*

The matter-energy brought to the assembly line through the distributor is changed into a usable form through the converter subsystem.   A system may assign specific members to this subsystem. Those members who prepare the input living and nonliving matter-energy for the processes of the system are part of the converter.   Many systems do not receive their matter-energy in immediately usable form.   Instead, the materials are sent to the system as a collective unit. Before these materials can be used to produce the system's product, they must be converted to suitable forms by separating the waste from the useful materials. Once this process is completed, artifacts, ranging from a screw driver to complicated manufacturing machinery, are commonly used to assist the system's components in processing the matter-energy through this subsystem.

An IED Cell always has to convert matter-energy into a usable form. The supplies and equipment that enter the cell are distributed collectively. The cell member responsible for receiving this matter-energy must separate the supplies from the equipment. For instance, the cell member must separate the bombs, wires and other IED materials from the assembly tools.

d.   *Producer (Producing Process)*

Now that the matter-energy is converted into usable forms, it is sent to the producer subsystem which is responsible for creating the system's products.   This subsystem is very critical to all systems.   The producer subsystem is responsible for making products needed by the system itself and/or other systems and synthesizing matter-energy for growth, repair, or replacement of system components.   Usually this subsystem is involved with generating a new component within a system after it has suffered damage.   In this case, the producer makes and repairs the components in the damaged system.

For example, IED Cells are always under attack.   As a result, the components within the cell that remain unharmed from the attack are used in the development of a new IED Cell that has the same properties of the old cell.   Or, the unharmed insurgents and their resources can be evenly distributed among the other IED

Cells to further their functioning capabilities. In general, the IED Cells have enough supplies needed for growth, damage repair and replacement of all levels within the organization. Technologically advanced insurgencies are generally more efficient producers while less advanced insurgencies require more energy to accomplish tasks.

In addition, the producer can make one or more IEDs that the cell members construct for use within the IED Unit or for other insurgencies. In some cases, the producer can assign information to the product. For example, after an IED is assembled there is information as to where the IED will be sent to, either a location or in the matter-energy storage, and who will retrieve the product, whether it is another insurgent group, cell, or consumer. The information and the IED are submitted as a package to be outputted by the cell. The amount of time and the proportion of the IED Cell's resources devoted to this process depend on the availability and cost of ready-produced materials, and the magnitude of the strains, such as the needs or demands within the group or its environment. For instance, if an IED Cell is damaged all of its members may have to rebuild their shelter. This situation can greatly reduce the quantity and production rate of IEDs.

e. *Matter-Energy Storage (Storing Process)*

This subsystem reserves and maintains a reserve for the system to be used later. It requires maintenance to prevent deterioration or theft, and the ability to find items when needed. Any unused products or materials from the system can also be warehoused in the same subsystem for later use. The physical structure of matter-energy storage can be a safe, underground cellar, or an external hard drive. Matter-energy that can be stored includes, but is not limited to, ammunition, weapons, fuel and food.

IED Cells have numerous storage places in the operational spaces they occupy for raw materials and other supplies. Blueprints and written instructions on how to make IEDs can also be warehoused in the same subsystem. A single cell member or all members within the cell may be responsible for maintaining and storing materials in storage and withdrawing them as needed, making one or more individuals components of this subsystem. However, one or more cell members assigned to this process must guard the storage units at all times to prevent theft and spoilage of good. The shelf-life of a

product or material has to be tracked by the cell member involved with this process since the amount of time a product or material can be warehoused in the matter-energy storage can affect productivity.

In addition, the storage facilities may serve storage purposes of another IED Cell. For example, if an IED Cell does not have any storage capabilities, it may use the storage facility of another IED Cell within the same insurgent IED Unit. Eliminating these storage units can decrease the energy within the IED Cell, thus making it easier to suppress it and others like it.

f. Extruder (Removing Process)

As mentioned previously, the distributor subsystem is also responsible for sending products and waste to the extruder subsystem. This subsystem takes the waste from the converter subsystem and purges it out of the system. The extruding process is an ongoing process within the system and is very necessary for the system to purge materials that does not contribute to the system's purpose, goal and overall operation or function.

Single or multiple cell members can be assigned to this subsystem. The components of this subsystem are those cell members who are responsible for removing products and wastes or unwanted inclusions, such as living intruders, from the area of the cell and people outside the cell (i.e., delivery boys) who arrange for products of the cell to be sent out to the environment. Some parts of a cell's territory and certain types of artifacts, like wastepaper baskets and garbage disposals, are often used to facilitate waste removal. In most cases, members put waste in containers and IEDs on distributor artifacts, such as moving belts, carts or delivery trucks. The waste and products are carried out of the cell's area by components who are not members of the cell, such as customers, triggermen and emplacers.

g. Motor (Moving Process)

This subsystem determines which direction the system will move in relation to other systems and its environment. This process may be accomplished by components which contain their own independent subsystems, such as systems moving

themselves by using their own equipment and other resources. Many IED Cells do not stay in one place for long periods of time. They are allowed to move about freely within their operational space. An IED Cell uses the motor subsystem to move the entire cell to locations within its internal environment to maximize its productivity or further accomplish its goals. For example, a cell might relocate to a city with high degrees of center of gravity or an area with concentrated counterinsurgency forces.

A cell member driving a bus or truck is an example of a component of an IED Cell's motor subsystem. Another possible sort of component is a cell member responsible for organizing and carrying out a move. The rate of movement of a cell is set by task demands and many other factors, both internal and external, like the threat of counterinsurgent attack. The amount of energy which a cell expends upon movement depends upon the physical strength of its members or other energy available to them.

h.   Supporter (Supporting Process)

The supporter subsystem holds the system together. How it fulfills that function though differs greatly from one system to another. The supporter is the skeletal structure that keeps the levels within the system in their proper physical relationship with one another. This process allows for interaction without interference, exemplified by crowding or weighting down of components.

IED Cell components involved in this process include the decider's timetable for movement of the cell, or the emplacer's positioning of a road side bomb prior to detonation. Other components involved are the internal and external social networks that provide the organization resources. The land, or culture, upon which the cell builds, can also be viewed as a supporter. Mountain ranges, desert, and other environmental features of the country in which the cell is located can determine the possible location of the insurgency. Changing these existing structures and terrain transforms the relationship between the IED Cell and its environment. Thus, the culture and social networks largely determine the kind and structure of the insurgency built in a given location.

Some other examples of a supporter in an IED Cell include structural features, such as the floor, walls, ceiling and other furniture or equipment of the cell. The building or infrastructure which houses the cell and the room which is the meeting place of the cell members not only acts as a boundary, but also as a supporter for the cell, helping maintain relationships among the members in space. Because the supporter subsystem is more of a structural feature instead of a process, the cell members have to take great care of their hideouts. If the IED Cell or some of its pieces of furniture or equipment collapse or become inoperable, then the cell members cannot carry out their functions.

All of the matter-energy processing subsystems in IED Cells are essential for their survival. All of these subsystems play a specific role in the functions and operations of the cell; no process is shared by two or more subsystems. While matter-energy is constantly being inputted, stored and outputted of the cell, information is also being processed in a similar manner. The next subsection describes how the IED Cell processes information through another series of subsystems.

3. Subsystems Processing Information

Ten of the twenty critical subsystems are involved in the processing of information, attesting to the paramount importance of information to any living system. One of the major functions of the Iraqi Insurgency is to provide information both from the environment to the insurgency and from the insurgency to the environment. The following subsystems—input transducer, decoder, internal transducer, memory, associator, decider, encoder, output transducer, and timer—transform the information into the appropriate forms needed for communication outside system boundaries and for internal communication between system's components.

a. Input Transducer (Inputting Process)

All initial information that is inputted into the system must be passed through this subsystem. The input transducer, like the ingestor, is responsible for bringing markers bearing information into a system. This subsystem changes the marker

into the appropriate form for further transmission and use within the specified system. The input transducer can also serve various specialized functions within each level of the system.

For example, every IED Cell may handle particular types of information. One IED Cell may be programmed to respond to particular energies that convey information to the cell. For instance, if the cell's operational environment changes, energy is given off by the environment that represents a possible counterinsurgency threat to the cell. Members within the cell can relay this information to the input transducer of other members within another IED Cell, IED Unit, or insurgency.

In addition, the input transducer can consist of components which change information into matter-energy, as exemplified by a phone conversation between two cell members being written down. Other examples of this process include intelligence reports being received by radio, satellite, or Internet, and cell members who bring information into the cell from the environment, transducing it from one form of matter-energy marker to another.

b.   Decoder (Decoding Process)

After the information is transmitted through the system, it is changed from a public to a private code that can be easily understood among the components within the system. The memory subsystem, which will be discussed later, may be used to determine the correct signals to assign to the private code. If the public code is similar to the private code, then this subsystem's processes may not be used. If the public code is different from the private code, the decoder is responsible for comparing the information code and determining its meaning to the system.

Examples of this process within IED Cells are cell members who interpret intelligence reports, translate languages, decode radio signals, decrypt secret messages, decipher secret messages and synthesize operational orders by insurgent leaders. Technologically advanced insurgencies may use electronic data processing systems to perform decoding processes, such as translating foreign languages and letters.

Words, pictures, sounds, and digital signals are other examples of symbols generated by the internal transducer for cell use. Symbols may group together, to develop the meaning of the original information, or they remain as a single powerful concept. For example, the intelligence reports sent to the cell may be in the form of a written document. All the words on the page must be grouped together in order to understand the meaning of the message. Or, the intelligence report might be a picture of a coalition casualty that will raise the morale of the members in the cell. In either form, they allow information transfer in the IED Cell.

In addition, the decoder must change the signal codes of information from the input transducer, and some information processed by the internal transducer, which is discussed next. The decoder process should not be confused with the processes from the input and internal transducer subsystems. The transducer subsystems alter the marker on the matter-energy while the decoder subsystem alters the code in which the information appears. The end result of the decoder process is information that has meaning to the members within the cell. This process can be local, limited to one component, or it may be laterally dispersed to several members or to all. For example, if the cell's decider receives an intelligence report from another cell decider, it must convert the message into a language that is easily understood by all the cell members.

c. *Internal Transducer (Monitoring Process)*

After the message has been decoded, the internal transducer changes the information markers of the message as necessary in order to communicate with other components within the system. The markers can be changed into matter-energy which can be transmitted within the organization. This process is accomplished by the components which monitor the internal process of the system.

IED Cells learn about their internal states by reports from members specially designated to be internal transducers, sensing changes in the cell, or perhaps from all members directly, each reporting changes in themselves. Some IED Cells often send representatives to make such reports to the deciders of the IED Unit at meetings. For example, the IED Cell decider might be responsible for reporting on the number of successful road side bomb explosions to the insurgency leadership.

d.   *Channel and Net (Circulating Process)*

After the system has received and understood the information that was sent to it, it can send feedback or circulate information through the channel and net subsystem, which is composed of multiple interconnected routes that bear information transmitted to all parts of the system. The channel subsystem may "intersect at points called nodes" (Miller, 1995). Systems may use the channels composed of nonliving parts of their environment or of artifacts. The channels connecting a system may be in the air or can be artifacts like the Internet, satellite, radio, and telephone wires. It can also be the individuals that pass information from one component to another. The net subsystem, on the other hand, can consist of the transmission paths through the air, cables, in written form, or spoken by the individual. The net subsystem is similar to the distributor subsystem; the only difference is that the former conveys markers bearing information and the latter convey matter-energy to all parts of the system.

In an IED Cell, the channel and net subsystem disburses information and messages among the other components within the cell. All cell members are a part of the channel and net subsystem, including the cell decider. The transmit information through verbal and written communication. Speech, gestures, facial expression, and postural changes are all examples of verbal communication while money, checks, and other financial papers are all examples of written communication. If the cell does not have the sophisticated means to send information to other cells or insurgencies, then a cell member may be appointed to go directly to the other cells and send the information verbally. In addition, cell members can pass information via the Internet, email and other computer networks within the cell. In some cases, IED Cells that are not in close proximity to one another, they send information using primarily electronic means or other forms of technology that is at its disposal.

Overall, the channel and net process is done simultaneously by all cell members. Some of channels and nets are critical to the insurgency's survival while others are not. In general, if this subsystems is attacked, the IED Cell will not have the energy or infrastructure to continue being resilient.

e. Associator (Relating Process)

After the information has been disseminated to the appropriate components within the cell via the channel and net subsystem, meaning must be assigned to the message. This is done with the assistance of the associator subsystem, which is the first stage of the learning process. The association of items of information must be done by one or more system components. In many systems at the group level, this process is laterally dispersed. The associator creates a relationship among the information and matter-energy in order to determine the system's future actions by analyzing its actions in previous situations. If there are any changes in the system's patterns, then the associator will be the first subsystem to notice.

For example, after the IED Cell's decider component, or cell leader, passes information along to the cell members, the members carry out his orders. The cell members' actions indicate that the association of the information has been made. How they associate the information can be done mentally or physically. Regardless how they associate the information, all cell members have to assemble the message into a comprehensive collection of information and compare the message to those stored in the memory subsystem, to look for similarities or differences.

As mentioned earlier, the associator process involves looking for any discrepancies that may indicate the cell is moving away from homeostasis in the form of internal or external threats. This process may also identify new opportunities to attack counterinsurgents. Intelligence can come from a variety of sources, such as other IED assemblymen within the cell, from members in the IED Unit or from local informants, and be assembled into collections of information. The associator looks at the results in light of past experience to find clues that might help the members in the cell determine future plans of action. The information collections and the results of the comparison to past collections are forwarded to the memory subsystem to be stored for future use.

An IED Cell must learn as a total system. It does this by modifying its structures and procedures with experience. It finds that certain structures or actions are associated with rewards more often than others. Over the years, an IED Cell may learn

the procedures which most often are associated with success over competitors. In general, this sort of learning arises from consensus of a majority of the components.

f.   Memory (Remembering Process)

The memory subsystem is the second stage of the learning process. It stores previous information and patterns of how the information has interacted in the past and tracks what decisions were made based on the information sent to the cell, and the results of the implementation of these decision—their relative success or failure. All the information in the memory subsystem can be stored and maintained in a physical space, such as a safe and underground cellar, or an accessible item, such as an external hard drive, notebook and computer, and retrieved as needed for the cell. The stored information can be retrieved at anytime in the future. A memory base grows if a system successfully accumulates experience that enables it to make better use of future inputs. However, over time, the preexisting information in the storage subsystem can be overwritten by new information that is inputted into the memory base. The memory process can also be done mentally through an organism's nervous system.

In some cases, however, particular cell members have special responsibility for keeping records or storing particular sorts of information, such as money tracking, blueprints of the IEDs. The cell member may have to document successful IED attacks against counterinsurgents or update the logs to reflect the current status of the cell's operations. Regardless how the memory is stored and retrieved for future use by the cell, the cell automatically creates a physical or mental library of successful and unsuccessful strategies. As the cell grows and matures, it continually refers to and modifies its library over and over again. The depth and quality of this library constitute a measure of the information inherent in the structure of the system and its order and complexity.

IED Cells that do record their effectiveness learn and remember the operations needed to launch highly destructive attacks. At any time, the cell can change its memory either by replacing outdated information with something more current, recording or retrieving information incorrectly, or losing it during storage. When the collective record of the insurgency ceases to exist, so does the system.

g.   *Decider (Deciding Process)*

After the IED Cell stores the information, it is sent to the decider subsystem for decision-making. This is the only essential critical subsystem and it cannot be dispersed to another system. The decider of a system at the group level may be a single component or all the members within the system. The decider subsystem receives and analyzes information inputs about the environment from the associator and the three previous subsystems and makes decisions that guide the insurgency towards its predetermined objectives. This subsystem can resolve conflicts, develop plans, allocate resources, evaluate performance, implement policy, synthesize information, and other decision related processes and activities. Miller states that the deciding process has four distinguishable stages: 1) establishing purposes or goals; 2) analysis; 3) synthesis; and 4) implementing.

h.   *Encoder (Encoding Process)*

Once the decider makes a decision of the system's next move, the message transferred to the encoder to be converted from a private to a public code that can be understood within the system. If the private and public codes are the same, then this subsystem will not be necessary. This process is the opposite of the decoder subsystem; it can be viewed as a selective editor that only allows information approved by the decider to leave the system. One or more members together within a system may constitute this subsystem.

IED Cells have many components in the encoder subsystem. Primary components might be the cell's decider that encodes the information from within his cell into a form communicable with the other cells in the insurgency or IED Unit. Some other examples may be cell members involved in coding of secret communications, writing or editing reports to insurgent leaders and translators. The insurgents themselves may also carry encoded information.

i.   *Output Transducer (Outputting Process)*

The output transducer takes the encoded information and changes the form of its markers from those used privately by the system into markers for public

understanding. It can also convert the new information into a form that is usable by other components within the system. This subsystem may be controlled by the decider subsystem since the system's relationship to other systems will be affected by this process and consist of representatives who report to echelons above them on the system's status.

For example, a designated cell member may have to send a written message or letter to another IED Cell or the IED Unit on the progress of IED production, demands or possible threats to the cell. All those involved with this process may spend an enormous amount of time and energy with output transducing. The decider, for instance, might have to send reports on the efficiency of the bomb maker and technicians and on the status of their work, reports of excesses or in adequate amounts of matter-energy and requests for correcting them, budget data, and other necessary housekeeping information requested by the IED Unit leadership. Artifacts that are commonly used in the processes of this subsystem include telephones, teletypewriters, radio, television, Internet and cell phones. Components which exemplify this process are cell members who are radio operators and public affair officers. Any message that is sent out by the IED Cell's component using one of the artifacts mentioned above is an input for another IED Cell.

j.   Timer (Timing Process)

This subsystem is responsible for "transmitting information to the decider about time-related states of the environment or the components within the system" (Miller, 1995). The information signals of the decider subsystem are used to coordinate a sequence of time events, such as start or stop a process. The time subsystem is also responsible for maintaining the spatial and temporal relationships in a system. This subsystem does not process information specifically. It keeps track of the events that occur within the cell, similar to an event list in a computer simulation program.

F. SUMMARY

After going through all the subsystems that process matter-energy, information and both, in an IED Cell, informed matter-energy is now created. The cell and Unit input information, processed it, and bring it into a new relationship with matter-energy. Matter-energy has likewise been inputted, processed, either used to power the cell and Unit and their operations, reforming the information in the final output. These processes are ongoing and occur simultaneously. Even though Miller's theory can be used to describe the IED Cell in the Iraqi Insurgency, his theory does have limitations. The next chapter discusses those limitations as well as the implications of using Miller's theory in understanding insurgencies.

VI. ASSESSMENT: DESCRIPTIVE AND EXPLANATORY MODELS, TIME AND FEEDBACK

This thesis constructs a unified general framework of insurgency. As such it includes the four living systems approaches described in Chapter II. However, the framework does not adequately incorporate the dynamics of an insurgency and feedback mechanisms.

The notion of time is of interest to many decision makers and military leaders studying insurgencies. Time helps them understand how an insurgency responds to changes in its environment, and, hence, find ways to disrupt it. Miller's revised edition of Living Systems includes a subsystem that accounts for time. The timer subsystem, as discussed in Chapter V, tracks the events that occur within the system, particularly subsystems that process information. However, its representation is static. From Figure 5 in Chapter V, one cannot deduce or infer how much time is needed for the subsystems to process matter-energy and information. It is important to note that the framework constructed in this thesis describes an insurgency as a snap shot in time, not over a period of time. Thus, as mentioned previously, only explanatory models can fully capture this aspect of insurgency.

In addition to time, feedback is very important in all living systems and is an integral part of Living Systems Theory. The work developed here provides a framework for insurgency that can incorporate feedback. Kilcullen's work on systems dynamics, as discussed in Chapter II, is an example of feedback in an insurgency. Feedback is not explicitly developed here.

Recall, the framework constructed in this thesis is a descriptive model. Only an explanatory model can adequately incorporate dynamics and feedback mechanisms. It is difficult to develop explanatory models of living systems that predict future behavior because there are many variables that need to be considered. And, many insurgent actions are in response to changes in the environment. It is necessary to first develop a descriptive model of insurgency that serves as a solid foundation for explanatory work that describes insurgent system dynamics.

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VII.   CONCLUSION

This thesis develops a unified general framework of insurgency. It identifies a broad, inclusive definition of insurgency, adopts a neutral interdisciplinary vocabulary, and develops a comprehensive description based on Living Systems Theory. Insurgencies are described as living systems that have inputs, outputs, throughputs, and boundaries. The resulting framework has a definition of insurgency and terminology that adequately describes the structure and processes of insurgency. The framework provides a language and structure to support a more productive dialogue among policy makers, military leaders and scholars.

The unified general framework based on Living Systems Theory yields a more inclusive framework to describe all insurgencies than the four other living systems approaches—social networks, sociobiology, ecology, and complex adaptive systems— discussed in Chapter II. The framework is "unifying" in that it includes all the physical and social science formulations of insurgencies and both contemporary and historical insurgencies, it is "general" in that it describes all insurgencies rather than a specific one. The framework fulfills the need for formulating a scientific approach that provides a general accepted definition and description of insurgency.

Prior to this work, a generally accepted framework did not exist. Currently, analysts are using several different scientific disciplines and approaches, such as historical analysis, political science, warfare, anthropology, mathematics, sociology, that attempt to describe the functions of an insurgency. The different frameworks lead to multiple, conflicting definitions and descriptions of insurgency that have made it difficult for policy makers to develop effective United States foreign policy. Some current frameworks have hindered policy makers, decision makers, and military leaders from formulating new approaches that fully encompass the scope of insurgencies and, hence, program them to think "in a box".

To demonstrate the effectiveness of the framework developed here, it is applied to the Iraq Sunni Insurgency. The framework is used to describe the structure of the insurgency system using three levels—insurgency, IED Unit, and IED Cell—and to describe the twenty critical subsystems that process information and matter-energy in the insurgency's IED Cell.

In summary, this framework should help clarify, focus, and support the current debates about policy, operations, and tactics for insurgencies.

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